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lightsource bp

GOULBURN RIVER SOLAR FARM

Biodiversity Development Assessment Report

FINAL

May 2023

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Biodiversity Development Assessment Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Lightsource bp

Project Director: Malinda Facey
Project Manager: Jessica Henderson Wilson
Technical Director: Rachel Musgrave
Technical Manager: Jacob Manners
Report No. 21507/R14
Date: May 2023

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V0	David Moore	04/07/2022	David Moore	04/07/2022
V1	Allison Riley	18/10/2022	Allison Riley	18/10/2022
V2	Rachel Musgrave	24/04/2023	Rachel Musgrave	02/05/2023

Executive Summary

Umwelt was engaged by Lightsource Development Services Australia Pty Ltd (Lightsource bp), the Proponent, to prepare this Biodiversity Development Assessment Report (BDAR) for the proposed Goulburn River Solar Farm (the 'Project'), located south-west of the township of Merriwa, NSW.

The Project is a State Significant Development (SSD), surrounded by the Goulburn River National Park. The Project will involve the construction, operation and decommissioning of a solar farm, which would generate approximately 550 MWp (Megawatt peak) of solar electricity, with a Battery Energy Storage System (BESS) of approximately 570 MWh (Megawatt hour) and an electrical substation to connect the solar farm to the existing 500 kV transmission line that runs through the Project Area.

This BDAR has been prepared by Umwelt to assess the potential biodiversity impacts of the Project in accordance with the Biodiversity Assessment Method (BAM).

Surveys identified the following Plant Community Types (PCTs) and vegetation which will be impacted by the Project:

- PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley (699.6 ha including 675.99 ha comprising derived native grassland).
- PCT 1661 Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin (96.09 ha including 90.02 ha of derived native grassland).

The completion of surveys and assessments identified that the Project would impact the following threatened entities listed within the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- mapped important habitat for the Regent Honeyeater (*Anthochaera phrygia*) – listed as critically endangered under the BC Act and EPBC Act, and is an entity with the potential for serious and irreversible impact (SAII)
- Barking owl (*Ninox connivens*) (breeding and foraging habitat) – listed as vulnerable under the BC Act
- White-throated Needletail (*Hirundapus caudacutus*) – listed as vulnerable under the EPBC Act
- Glossy-black Cockatoo (*Calyptorhynchus lathami*) (foraging habitat only) – listed as vulnerable under the BC Act and EPBC Act
- Diamond Firetail (*Stagonopleura guttata*) – listed as vulnerable under the BC Act
- Dusky Woodswallow (*Artamus cyanopterus*) – listed as vulnerable under the BC Act
- Little Lorikeet (*Glossopsitta pusilla*) – listed as Vulnerable under the BC Act
- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland critically endangered ecological community (CEEC) listed under the BC Act and the EPBC Act which is a potential serious and irreversible impact entity.

The following key impact avoidance and mitigation measures have been identified for the Project:

- Biodiversity impact avoidance through Development Footprint alterations which have resulted in biodiversity impact avoidance through an initial-avoidance of approximately 38% (reducing from 2,000 ha to 1,249 ha) of the project area, a secondary approximately 30% reduction in Development Footprint area (reducing from 1,249 ha to 882 ha) and a further approximately 10% reduction in Development Footprint (882 ha to 799.5 ha).
- Selection of higher rated capacity solar panels to ensure that the Development Footprint is minimised, the Project retains a capacity of a 550 MWp of solar electricity and the cost of purchasing the solar panels maintains the Project's economic viability.
- Optimising opportunities to maintain connectivity between the Project Area and surrounding Goulburn River National Park and within the Project Area through limiting fencing to strategic areas.
- Redesign of the Project to minimise impacts on areas of mapped Regent Honeyeater important habitat (the generic mapping includes both areas of scattered trees and grassland).
- Alteration of the Project to reduce impacts to suitable breeding habitat for the Barking Owl.
- Alteration of the Project to avoid impact to PCTs associated with habitat for the Large-eared Pied bat (*Chalinolobus dwyeri*) and the Eastern Cave Bat (*Vespadelus troughtoni*).
- Reduction of the Development Footprint to avoid impacts to areas of PCT 1607 Blakely's Red Gum - Narrow-leaved Ironbark - Rough-barked Apple shrubby woodland of the upper Hunter.
- Reduction of the Development Footprint to avoid impacts to areas of PCT 1655 Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin which corresponds to the Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion vulnerable ecological community (VEC).
- Reduction and alteration of the Development Footprint to minimise impacts to areas of the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC. This included impact avoidance measures targeted at retaining areas of woodland with intact crown condition, areas of scattered trees and higher quality derived native grassland condition zones.
- Establishment of exclusion zones within the Development Footprint to avoid Redlynch Creek which crosses the Project Area, and the remnants of a historic Slab Hut of historic heritage importance.

Following the application of avoidance and mitigation measures, the following biodiversity credits are required to offset the impacts of the Project:

Entity	Credits Required
PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	4642 credits
1661 Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	136 credits
Regent Honeyeater (*Anthochaera phrygia*)	1546 credits
Barking Owl (*Ninox connivens*)	7 credits

Declaration

i. Certification under clause 6.15 Biodiversity Conservation Act 2016

I certify that this report has been prepared, to the best of my knowledge, based on the requirements of, and information provided under, the Biodiversity Assessment Method (2020) and clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

Name: Jacob Manners

Signature: 

Date: 2 May 2023

BAM Assessor Accreditation no: BAAS17099

Glossary

Term/Abbreviation	Definition
AIAPs	Additional impact assessment provisions for SAII
AOBV	Areas of Outstanding Biodiversity Value
Assessment Area	Includes the Development Footprint and the area of land within the 1500 m buffer zone surrounding the development footprint (or 500 m buffer for linear developments).
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BCD	Biodiversity, Conservation, and Science Division within NSW Department of Planning and Environment
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BESS	Battery Energy Storage System
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offsets Scheme
BSA	Biodiversity Stewardship Agreement
CEEC	critically endangered ecological community
CEMP	Construction Environmental Management Plan
Development Footprint	The area of land that is directly impacted by a proposed development, the disturbance footprint.
Development Site	An area of land that is subject to a proposed development under the EP&A Act, including areas which will be retained and impacted by the project (synonymous with Subject Land and Project Area).
DBH	diameter at breast height over bark
DPE	Department of Planning and Environment (NSW)
DPIE	Department of Planning, Industry, and the Environment (NSW) (superseded, now DPE)
EAH	Environmental Agency Head
EC	ecological community listed under the EPBC Act
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EEC	endangered ecological community
EIS	Environmental Impact Statement
EPC	Engineering Procurement Contractor
FM Act	*Fisheries Management Act 1994* (NSW)
GIS	Geographic Information System

Term/Abbreviation	Definition
GPS	Global Positioning System
HTW	high threat weed
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LLS Act	*Local Land Services Act 2013* (NSW)
MNES	matters of national environmental significance
MWh	Megawatt hour
MWp	Megawatt peak
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
NVR Mapping	Native Vegetation Regulatory Mapping
PCT	Plant Community Type
Project Area	The broader property area that the subject land is located within.
SAII	serious and irreversible impact
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
STVM	State Vegetation Type Map
Subject Land	The land subject to the development application (synonymous with development site). The Development Footprint/disturbance footprint is located within the Subject Land area.
TBDC	Threatened Biodiversity Data Collection
TEC	threatened ecological community
The Project	The proposed Goulburn River Solar Farm. The Project includes the construction, operation and decommissioning of a solar farm with capacity of up to 550 MW, a 280 MWp and 570 MWh BESS and associated infrastructure.
TSSC	Threatened Species Scientific Committee – DCCEEW
VEC	vulnerable ecological community

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1.0 Introduction

1.1 Overview

Lightsource Development Services Australia Pty Ltd (Lightsource bp) has engaged Umwelt (Australia) Pty Ltd (Umwelt) to prepare this Biodiversity Development Assessment Report (BDAR) for the proposed Goulburn River Solar Farm (the Project) within the locality of Merriwa, NSW.

The Project includes the following two main components for the purposes of assessment under the Biodiversity Assessment Method (BAM) (NSW DPIE 2020a):

- A Solar Farm.
- Public Road and Culvert Upgrade Works.

Two separate BDARs have been prepared as the Solar Farm requires a site-based assessment and the public road and culvert upgrade works require a linear-based assessment under the BAM. This BDAR assesses the impacts associated with the proposed Solar Farm.

1.2 Purpose and Scope of this Report

This BDAR has been prepared as part of the Environmental Impact Statement (EIS) documentation for the Project to address the Secretary's Environmental Assessment Requirements (SEARs) in relation to biodiversity for the proposed Solar Farm (refer **Table 1.1**). This report provides an assessment of the biodiversity values of the Development Footprint, documents the application of the avoid, minimise and offset framework and assesses the likely biodiversity impacts of the Project. Umwelt has prepared a separate Biodiversity Development Assessment Report (BDAR) for the public road and culvert upgrade component of the Project (See Appendix 7 of the EIS).

This BDAR has been prepared in accordance with the *Biodiversity Conservation Act 2016* (NSW) (BC Act) and the Biodiversity Assessment Method (BAM) (NSW DPIE 2020a). The Project is a State Significant Development (SSD) under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and is therefore required to be accompanied by a BDAR in accordance with Section 7.9 of the BC Act.

The Project requires approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act). The BAM has been endorsed as the assessment method for Matters of National Environmental Significance under a Bilateral Agreement made under the EPBC Act. The Australian Government is the decision-maker for whether the Project will be approved under the EPBC Act. Nationally listed threatened species threatened ecological communities (TECs) and migratory species have been considered and assessed as part of this BDAR.

Table 1.1 SEARs Relevant to the Biodiversity Assessment

Key Issues	Secretary's Environment Assessment Requirements	Where addressed
SEARs		
Biodiversity	An assessment of the biodiversity values and the likely biodiversity impacts of the project in accordance with Section 7.9 of the *Biodiversity Conservation Act 2016* (NSW), the Biodiversity Assessment Method (BAM) 2020 and documented in a Biodiversity Development Assessment Report (BDAR), unless BCS and DPIE determine the proposed development is not likely to have any significant impacts on biodiversity values	The BDAR itself
	The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the BAM	**Section 7.0** and **Section 8.0** of this BDAR
	An assessment of the likely impacts on listed aquatic threatened species, populations or ecological communities, scheduled under the Fisheries Management Act 1994, and a description of the measures to minimise and rehabilitate impacts, and	Appendix 7 of the EIS
	If an offset is required, details of the measures proposed to address the offset obligations.	**Section 11.3** of this BDAR
Biodiversity Conservation Division (BCD) Submission		
Biodiversity	1. Biodiversity impacts related to the proposed development (SSD-33964533) are to be assessed in accordance with the Biodiversity Assessment Method 2020 and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the *Biodiversity Conservation Act 2016* (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and Biodiversity Assessment Method 2020.	The BDAR itself.
	2. The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method 2020.	**Section 7.0** and **Section 8.0** of this BDAR.
	3. The BDAR must include details of the measures proposed to address the offset obligation as follows. • The total number and classes of biodiversity credits required to be retired for the development/project. • The number and classes of like-for-like biodiversity credits proposed to be retired. • The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules. • Any proposal to fund a biodiversity conservation action. • Any proposal to conduct ecological rehabilitation (if a mining project). • Any proposal to make a payment to the Biodiversity Conservation Fund.	**Section 11.0** of this BDAR.

Key Issues	Secretary's Environment Assessment Requirements	Where addressed
	If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.	
	4. The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the *Biodiversity Conservation Act 2016.*	**Section 1.3** of this BDAR.
EPBC Act Assessment Requirements – supplementary SEARs		
General requirements – Relevant regulations	5. The Environmental Impact Statement (EIS) must address all matters outlined in Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth) and all matters outlined below in relation to the controlling provisions.	**Appendix A** of this BDAR.
General requirements – Project description	6. The title of the action, background to the action and current status.	**Appendix A** of this BDAR.
	7. The precise location and description of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the action that may have impacts on MNES.	**Appendix A** of this BDAR.
	8. How the action relates to any other actions that have been or are being taken in the region affected by the action.	**Appendix A** of this BDAR.
	9. How the works are to be undertaken and design parameters for those aspects of the structures or elements of the action that may have relevant impacts on MNES.	**Section 1.4** of this BDAR.
General requirements – Impacts	10. The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: • a description and detailed assessment of the nature and extent of the likely direct, indirect and consequential impacts, including short term and long term relevant impacts. • a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible. • analysis of the significance of the relevant impacts; and • any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	**Appendix A** of this BDAR.

Key Issues	Secretary's Environment Assessment Requirements	Where addressed
General requirements – Avoidance, mitigation, and offsetting	11. For each of the relevant matters protected that are likely to be significantly impacted by the action, the EIS must provide information on proposed avoidance and mitigation measures to manage the relevant impacts of the action including: • a description, and an assessment of the expected or predicted effectiveness of the mitigation measures, • any statutory policy basis for the mitigation measures. • the cost of the mitigation measures. • an outline of an environmental management plan that sets out the framework for continuing management, mitigation and monitoring programs for the relevant impacts of the action, including any provisions for independent environmental auditing. • the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	**Section 7.0** and **Appendix A** of this BDAR.
	12. Where a significant residual adverse impact to a relevant protected matter is considered likely, the EIS must provide information on the proposed offset strategy, including discussion of the conservation benefit associated with the proposed offset strategy.	**Appendix A** of this BDAR.
	13. For each of the relevant matters likely to be impacted by the action the EIS must provide reference to, and consideration of, relevant Commonwealth guidelines and policy statements including any: • conservation advice or recovery plan for the species or community • relevant threat abatement plan for the species or community • wildlife conservation plan for the species; and • any strategic assessment. **Note:** the relevant guidelines and policy statements for each species and community are available from the Department of the Environment Species Profiles and Threats Database. (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl)	**Appendix A** of this BDAR.
	14. In addition to the general requirements described above, specific information is required with respect to each of the determined controlling provisions. These requirements are outlined in paragraphs 15–17.	**Appendix A** of this BDAR.

Key Issues	Secretary's Environment Assessment Requirements	Where addressed
Biodiversity (threatened species and communities and migratory species)	15. The EIS must identify each EPBC Act listed threatened species and community and migratory species likely to be impacted by the action. For any species and communities that are likely to be impacted, the proponent must provide a description of the nature, quantum and consequences of the impacts. For species and communities potentially located in the project area or in the vicinity that are not likely to be impacted, provide evidence why they are not likely to be impacted.	**Appendix A** of this BDAR.
	16. For each of the EPBC Act listed threatened species and communities and migratory species likely to be impacted by the action the EIS must provide a separate: • description of the habitat (including identification and mapping of suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival), with consideration of, and reference to, any relevant Commonwealth guidelines and policy statements including listing advice, conservation advice and recovery plans; • details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Australian Government guidelines and policy statements; • description of the relevant impacts of the action having regard to the full national extent of the species or community's range; and • description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action; • identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account; • a description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established. • details of how the current published NSW Biodiversity Assessment Method (BAM) has been applied in accordance with the objects of the EPBC Act to offset significant residual adverse impacts; and • details of the offset package to compensate for significant residual impacts including details of the credit profiles required to offset the action in accordance with the BAM and/or mapping and descriptions of the extent and condition of the relevant habitat and/or threatened communities occurring on proposed offset sites.	**Appendix A** of this BDAR. Impact avoidance measures are also described in **Section 7.0**.

Key Issues	Secretary's Environment Assessment Requirements	Where addressed
	Note: For the purposes of approval under the EPBC Act, it is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a proposed action and deliver an overall conservation outcome that improves or maintains the viability of the MNES i.e., 'like for like'. In applying the BAM, residual impacts on EPBC Act listed TECs must be offset with Plant Community Type(s) (PCT) that are ascribed to the specific EPBC listed ecological community. PCTs from a different vegetation class will not generally be acceptable as offsets for EPBC listed communities.	
	17. Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the EPBC Act 1999 Environmental Offset Policy. (http://www.environment.gov.au/epbc/publications/epbc-act-environmental-offsets-policy.)	
Appendix A **Protected matters relevant to the Goulburn River Solar Farm (EPBC 2021/9102) project**	Based on the information in the referral documentation, the location of the action, species records and likely habitat present in the area, there are likely to be significant impacts to: • White Box-Yellow Box-Blakley's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered. • Regent Honeyeater (*Anthochaera phrygia*) – Critically Endangered. Additionally, there is some risk that there may be significant impacts on the following matters and further assessment to determine if the communities and species listed below are present in the proposed action area and, if so, the extent to which they may be impacted by the proposed action, is required: • Central Hunter Valley Eucalypt Forest and Woodland – Critically Endangered. • Swift Parrot (*Lathamus discolor*) – Critically Endangered. • Painted Honeyeater (*Grantiella picta*) – Vulnerable. • Large-eared Pied Bat (*Chalinolobus dwyeri*) – Vulnerable. • Corben's Long-eared Bat (*Nyctophilus corbeni*) – Vulnerable. • Pink tailed Worm-lizard (*Aprasia parapulchella*) – Vulnerable. • Bluegrass (*Dichanthium setosum*) – Vulnerable. • *Homoranthus darwinioides* – Vulnerable. Several threatened species and ecological communities have been identified as priority management species following the 2019–2020 bushfires. This includes the White Box-Yellow Box-Blakley's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community and the Regent.	**Appendix A** of this BDAR.

Key Issues	Secretary's Environment Assessment Requirements	Where addressed
	Honeyeater (as discussed above), and the following listed species that may be impacted by the proposed action: • Koala (*Phascolarctos cinereus*) (Combined Population of QLD, NSW and the ACT) – Vulnerable. • Greater Glider (*Petauroides Volans*) – Vulnerable. • Brush tailed Rock wallaby (*Petrogale penicillata*) – Vulnerable. • Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (*Dasyurus maculatus maculatus*) (South-east mainland population)) – Endangered. • New Holland Mouse, Pookila (*Pseudomys novaehollandiae*) – Vulnerable. • Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable. Further analysis of the impacts of the fires on those species and communities identified above should be undertaken during the assessment. **Note:** uncertainty around the extent and number of protected matters that may be impacted will need to be resolved through the assessment process once final alignment and construction plans have been completed. **Note:** this may not be a complete list and it is the responsibility of the proponent to ensure any protected matters under these controlling provisions are assessed for the Commonwealth decision-maker's consideration.	

1.3 Report Preparation

This BDAR was prepared by Jacob Manners (Senior Ecologist) with review and technical direction from Rachel Musgrave (NSW Ecology Manager – Sydney / Principal Ecologist) and Allison Riley (Ecology Manager Southeast Australia / Principal Ecologist). The BDAR was prepared in accordance with the BAM, following the specific requirements detailed within Appendix K of the BAM (see **Appendix B**).

Table 1.2 outlines the details of the ecologists involved in the survey, calculations and reporting for the Project.

Table 1.2 Accredited BAM Assessors and their role on this Project

Name	Experience / Qualifications	BAM Accreditation Number	Contribution to the project
Jacob Manners	MWldMgt, BSc	BAAS17099	Biodiversity Assessment Project Manager, Accredited assessor, BAM plots, PCT mapping and threatened species surveys
Allison Riley	BSc	BAAS17042	Document Review / Technical Project Director to Dec 2022
Rachel Musgrave	Bsc (Hons)	BAAS18032	Document Review / BAM Plots / Technical Project Director from Dec 2022
Patricia Robinson	BEnvSc	BAAS18123	Threatened flora surveys / BAM Plot Surveys
Belinda Howe	BEnvScMgt	BAAS21019	Threatened species surveys
Sarah Hart	MSc, BSc, Dip EnvMgt	BAAS21026	Threatened species surveys and BAM Plots
Rebecca Vere	MEnvMgt, Bsc(Hons)	-	Threatened species surveys
Joel Callaghan	BSc (Hons)	-	Threatened species surveys and PCT Mapping
Matthew Mullaney	BEnvSc	-	Threatened species surveys and BAM Plots
Jarmin Thornberry	BEnvScMgt Dip CLMgt	-	Threatened species surveys and BAM Plots
William Brown	BEnvScMgt	-	Threatened species surveys
Alex Cottle	BEnvScMgt	-	Threatened species surveys
Kate Faber	BEnvScMgt	-	Threatened species surveys

1.4 Proposed Development

1.4.1 Development Overview

The Project is a proposed solar farm which includes construction, operation, maintenance and eventually decommissioning works. The solar farm is proposed to generate approximately 550 MWp (Megawatt peak) of solar electricity, with a Battery Energy Storage System (BESS) of approximately 570 MWh (Megawatt hour) and an electrical substation to connect the solar farm to the existing 500 kV transmission line that runs through the Project Area.

1.4.2 Location and Subject Land Description

The Goulburn River Solar Farm is located approximately 28 kilometres (km) southwest of the township of Merriwa and is surrounded by the Goulburn River National Park. It is within the Upper Hunter Local Government Area (LGA) of New South Wales (NSW). The boundary of the Project Area and Development Footprint is shown on the Site Map provided as **Figure 1.1** and the Location Map, provided as **Figure 1.2**.

The elevated central parts of the Project Area are located on the Liverpool West Basalt rock unit, with surrounding areas on the Banks Wall Sandstone rock unit, which is part of the Narrabeen Group sandstones (Colquhoun *et al.*, 2021). The areas influenced by the Liverpool West Basalt rock unit are highly productive and have been historically cleared and continue to be utilised for livestock grazing on improved pastures.

The current site vegetation consists of a mosaic of exotic dominated pasture vegetation where pasture improvement has taken place, derived native grasslands subject to various degrees of disturbance in various timeframes, isolated paddock trees, areas of thinned trees and intact woodland and forest around the periphery of the Project Area.

1.4.3 Proposed Development Description

The Development Footprint and Project Area are mapped in **Figure 1.3**. The key components of the Project include:

- Approximately one million bifacial solar PV modules in an east-west single-axis tracking arrangement with an average height of approximately 3.1 m at full tilt, and with a maximum of 4 m in some areas due to undulating site topography.
- A BESS with an approximate 280 MWp and 570 MWh capacity. The BESS would most likely comprise of a lithium phosphate iron battery system, to be housed in a series of outdoor containers, aggregated in one central location. The BESS would be located adjacent the substation in the south east corner of the Project Area.
- Onsite 500 kV switchyard and substation, with underground electrical conduits and cabling leading into the yard and overhead lines reaching above to the existing transmission line. An additional tower may be erected on the current line to accommodate the grid connection.
- Onsite power line connection via underground electrical conduits and cabling.
- Communications tower, up to 30 m high, providing communications, radio and cellular services to the site and wider region.

- Internal access roads allowing for site maintenance.
- Site office and operations and maintenance building with parking for the operations team.
- Primary solar farm site access point from the existing driveway from Wollara Road, with additional existing access points to be maintained along the north-western boundary of the Project Area for emergency use.
- Drainage line crossings if and where required to manage existing surface water flows (to be determined during further design development) and access points for construction purposes.
- Security fencing around the three discrete Development Footprint areas, installation of crossing gates, water tanks or dams, and fencing and potential alternate secondary access points to facilitate ongoing livestock grazing.

1.4.4 Project Site Selection and Biodiversity Design Considerations

The following design considerations have been factored into the selection of the Development Footprint and biodiversity impact avoidance:

- The Project Area was selected for the location of a solar farm due to the presence of an existing 500 kV transmission line, which means that there will be no requirement for a new electricity transmission line or associated impacts. To ensure that the Project remains economically viable the total capacity of solar production needs to remain at or above a 550 MWp of solar electricity.
- The Project Area is also characterised by suitable terrain and topography, high quality solar irradiance and ideal climatic conditions and access to major transport networks for delivery of construction materials. There is only one surrounding land holder (the NSW Government) and the visual impacts associated with the Project can be managed through the screening provided by the Goulburn River National Park.
- The Project Area (2000 ha) has provided flexibility in design to prioritise avoidance of high value biodiversity areas and the subject land has been already impacted by widespread clearing and ongoing pasture improvement works for agricultural use.

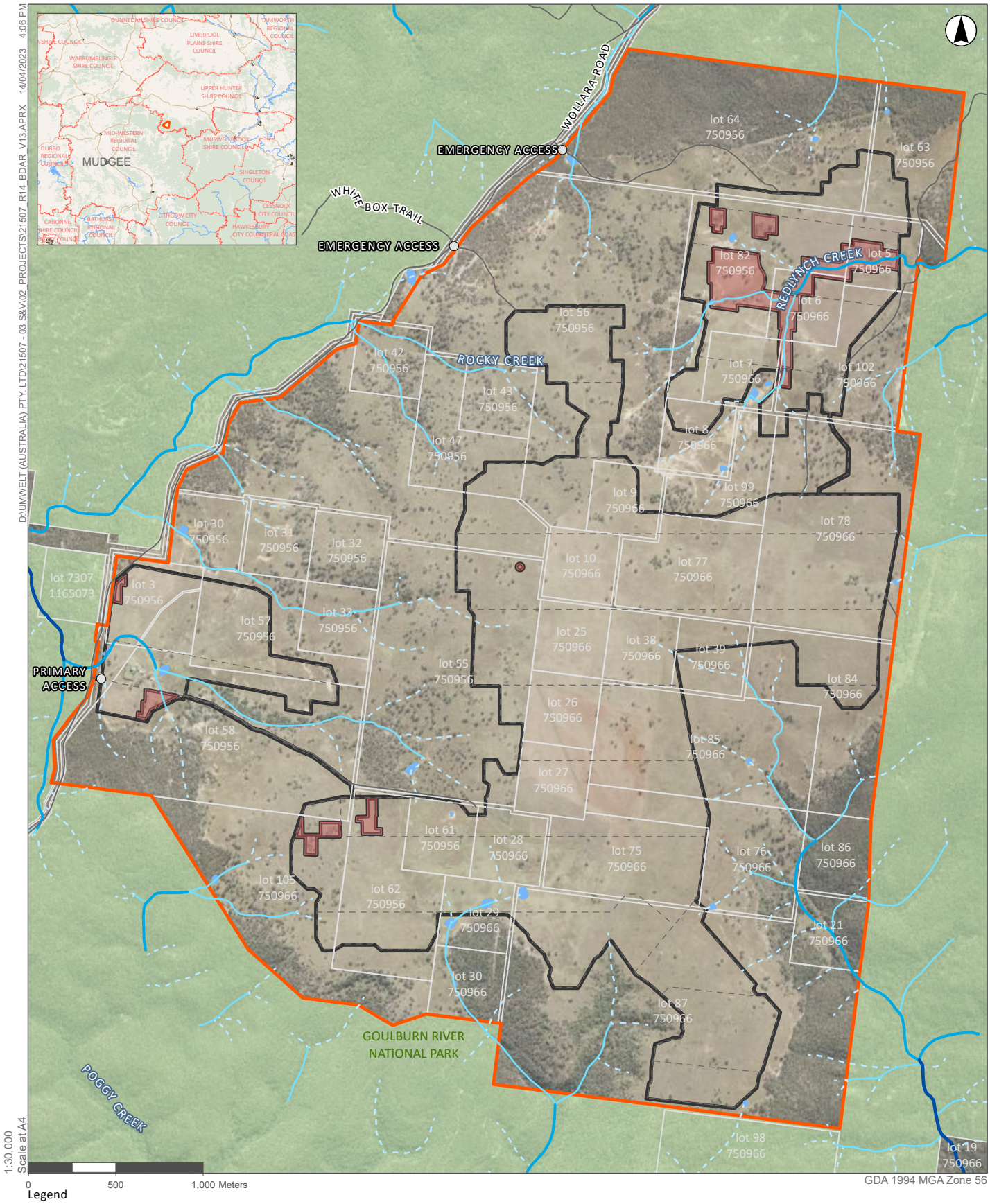
Throughout the EIS preparation and scoping phases of the Project several design refinements have occurred including:

- Development Footprint alterations have resulted in biodiversity impact avoidance through an initial avoidance of approximately 38% (reducing from 2,000 ha to 1,249 ha) of the project area, a secondary approximately 30% reduction in Development Footprint area (reducing from 1,249 ha to 882 ha) and a further secondary approximately 10% reduction in Development Footprint (882 ha to 799.5 ha).
- Selection of higher rated capacity solar panels to ensure that the Development Footprint is minimised, the Project obtains a capacity of a 550 MWp of solar electricity and the cost of purchasing the solar panels maintains the Project's economic viability.
- Optimising opportunities to maintain connectivity between the Project Area and surrounding Goulburn River National Park and within the Project Area through limiting fencing to strategic areas.

- Redesign the Project to minimise impacts on areas of mapped Regent Honeyeater (*Anthochaera phrygia*) important habitat (the generic mapping includes both areas of scattered trees and grassland).
- Alteration of the Project to reduce impacts to suitable breeding habitat for the Barking Owl (*Ninox connivens*).
- Alteration of the Project to avoid impact to Plant Community Types (PCTs) associated with habitat for the Large-eared Pied bat (*Chalinolobus dwyeri*) and the Eastern Cave Bat (*Vespadelus troughtoni*).
- Reduction in the area occupied by the Project for the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (listed as critically endangered under both the BC Act and EPBC Act) to avoid areas of woodland with intact crown condition and resulting in impact minimisation to areas to areas of scattered trees and derived native grassland condition zones.
- Establishment of exclusion zones within the Development Footprint to avoid Redlynch Creek which crosses the Project Area, and the remnants of a historic Slab Hut of historic heritage importance.

1.4.5 Other Documentation

Other information sources relied upon are referenced in the text and are listed in the References Section of this Report (**Section 12.0**).



Legend

- Access Points
- Proposed Access Tracks
- Existing Roads and Tracks
- Property Boundaries
- Project Area
- NSW National Parks
- Development Footprint
- Exclusion Zones - Environmentally Sensitive Areas

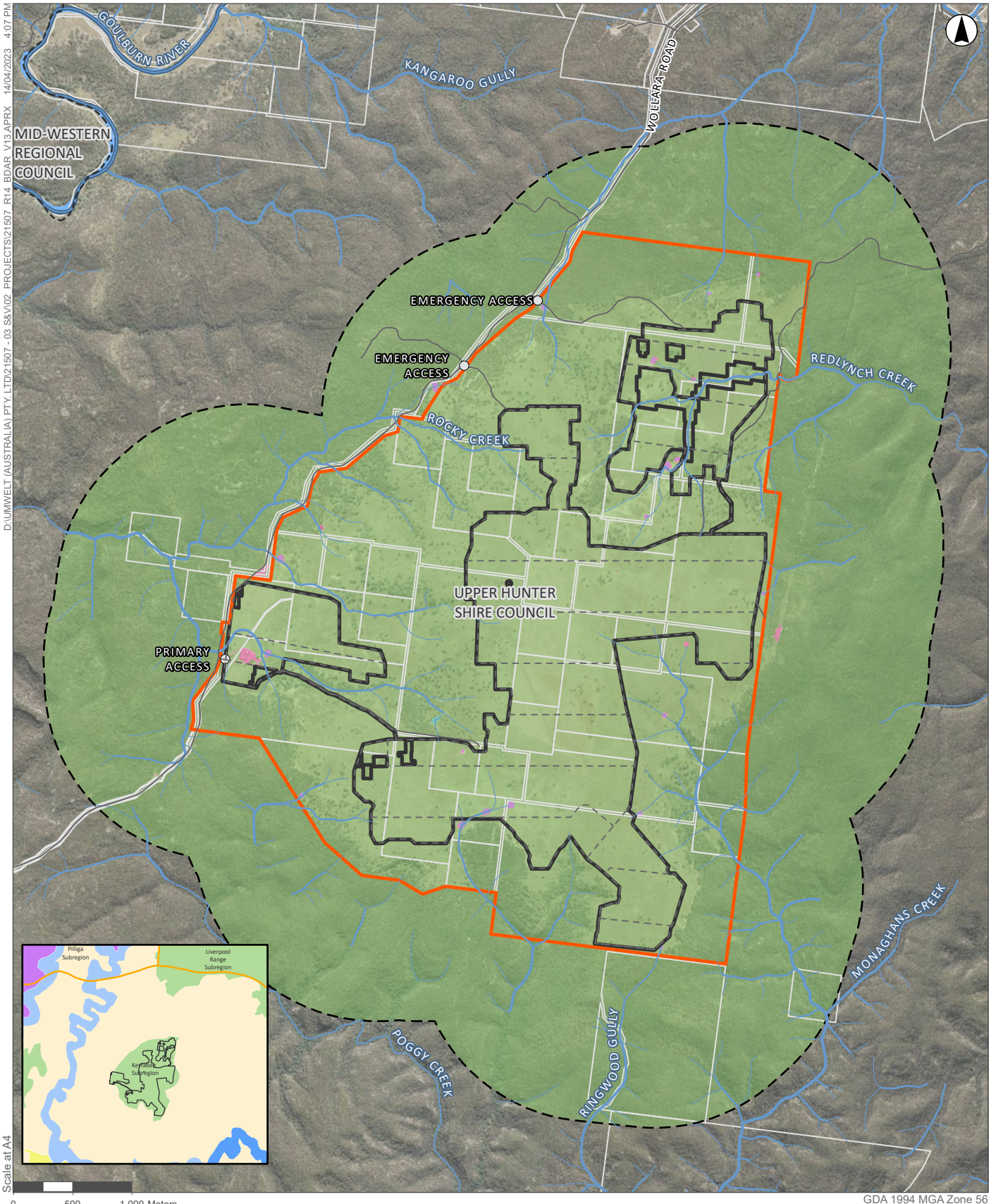
Stream Order

- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream

FIGURE 1.1

Site Map

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)



Legend

- Access Points
- Proposed Access Tracks
- Existing Roads and Tracks
- Watercourse
- 1500m Buffer Area (Total extent = 4586.84 ha)
- Property Boundaries
- Development Footprint
- Project Area
- IBRA Regions
- Native Vegetation Extent (Total Area = 4569.17 ha / 99.61% of Assessment Area)
- Non-native / Cleared Land (Total Area = 17.67 ha)

Mitchell Landscapes

- Goulburn River Channels and Floodplains
- Lees Pinch Foothills
- Liverpool Range Valleys and Footslopes

FIGURE 1.2

Location Map

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

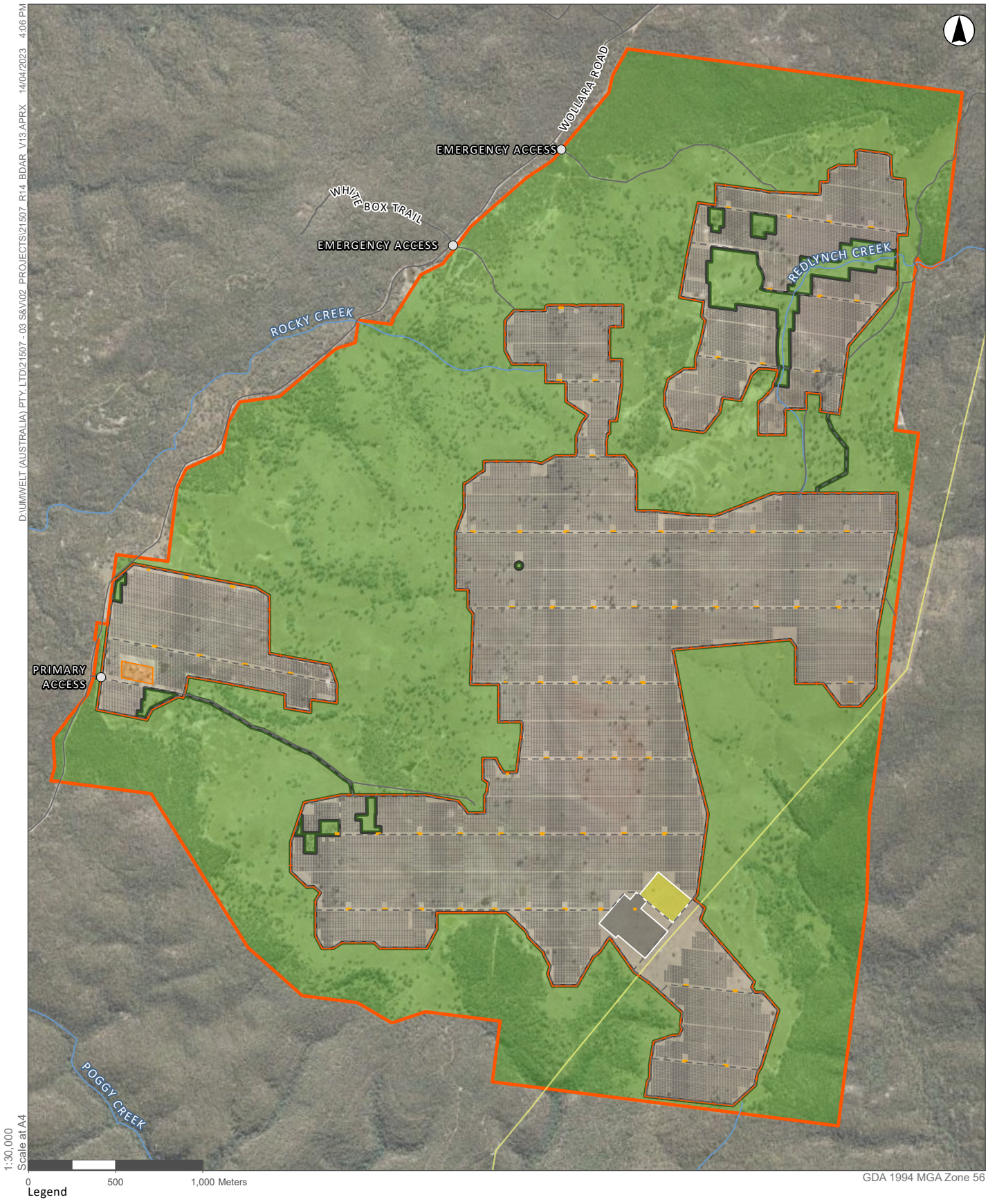


FIGURE 1.3

Development Layout

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

1.5 Statutory Considerations

Commonwealth and State legislation relevant to this BDAR is described in **Table 1.3**.

Table 1.3 Legislation Relevant to the Project

Relevant legislation	Governing Agency	Summary
Commonwealth legislation		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Department of Climate Change, Energy, the Environment and Water (DCCEEW)	The EPBC Act is the Commonwealth Government's primary piece of environmental legislation and is administered by the Australian Government DCCEEW. It is designed to protect national environmental assets, known as MNES, which include threatened species of flora and fauna, endangered ecological communities, and migratory species, as well as other protected matters. It defines the categories of threat for threatened flora and fauna, identifies key threatening processes and provides for the preparation of recovery plans for threatened flora, fauna, and communities. Preliminary investigations identified that the Project would likely have a significant impact on biodiversity protected under the EPBC Act. A referral was subsequently prepared and submitted, with the Project being determined to be a controlled action (ref 2021/9102) under the EPBC Act on 2 February 2022. The controlled action included the requirement for the Proposal to be assessed by an accredited assessment under EP&A Act. The Proposal will be assessed under the Bilateral Agreement between the Commonwealth and NSW, which will then be used to inform the Commonwealth Environment Minister's determination. The Commonwealth Assessment Requirements and where this BDAR addresses each requirement are summarised in **Table 1.1**.
NSW legislation		
Environmental Planning and Assessment Act 1979 (EP&A Act)	Department of Planning and Environment (DPE)	The EP&A Act is the overarching planning legislation in NSW that provides for the creation of planning instruments that guide land use. The EP&A Act also provides for the protection of the environment, including the protection and conservation of native animals and plants. This includes threatened species, populations and ecological communities, and their habitats of biodiversity values, as listed in the NSW BC Act and NSW *Fisheries Management Act 1994* (FM Act). Section 4.36 of the EP&A Act provides for the declaration of a project as SSD. Under the EP&A Act, the declaration of a project as SSD can be made by meeting the requirements of a State Environmental Planning Policy (SEPP) or by the Minister for Planning and Homes. Clause 20 of Schedule 1 of Planning Systems SEPP prescribes that development for the purpose of 'electricity generating works' that has a capital investment value of more than $30 million is SSD. The Project has a capital investment value of greater than $30 million.

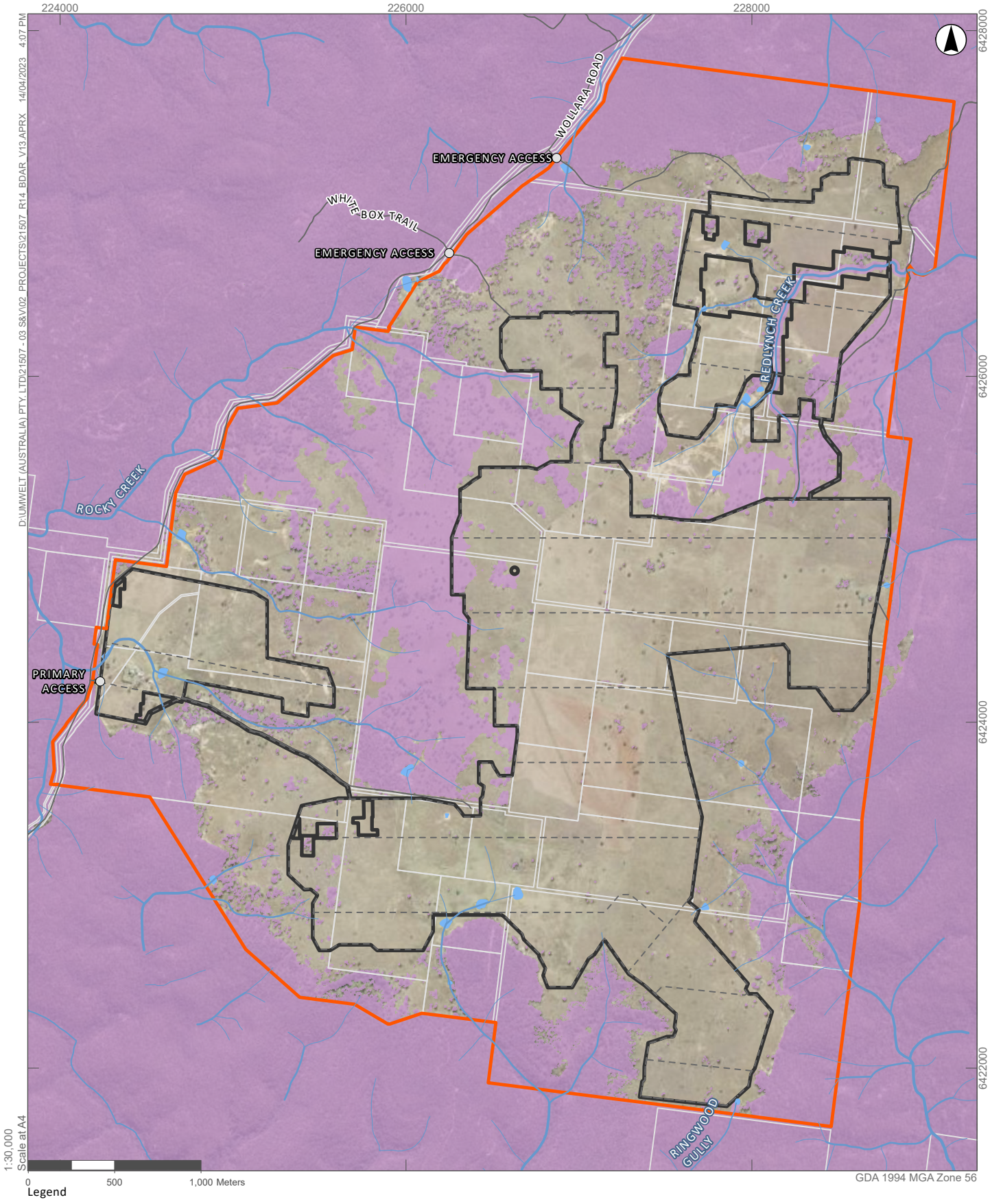
Relevant legislation	Governing Agency	Summary
		As SSD, the Proposal would be assessed under Part 4 Division 4.7 section 4.36 of the EP&A Act. The Minister for Planning and Homes is the consent authority for SSD. The Minister (or the Minister's delegate) is required to take into consideration the matters listed under section 4.15 of the EP&A Act when determining the development application (DA). Under Division 4.4 section 4.39 an EIS is required to accompany a DA that has been determined as SSD. The proponent is required to consult with the Secretary of DPE with regard to the matters to be addressed in the EIS. These are referred to as the SEARs. The SEARs for the Project were issued by DPE on 1 February 2021. Broadly, the SEARs require biodiversity impacts related to all stages of a proposal to be assessed in accordance with section 7.9 of the BC Act and documented in a BDAR. The SEARs and where this BDAR addresses each requirement pertaining to biodiversity are summarised in **Table 1.1.**
Biodiversity Conservation Act 2016 (BC Act)	DPE	The BC Act and its supporting regulations commenced on 25 August 2017. The BC Act sets out the environmental impact assessment framework for threatened species, TECs and Areas of Outstanding Biodiversity Value (formerly critical habitat) for Major Projects, Part 5 activities, and local development. The BC Act provides a framework to avoid, minimise and offset the impacts of proposed development and established a methodology for assessing the likely impacts on biodiversity values and calculating measure to offset those impacts (the BAM). Sections 7.9 of the BC Act requires that SSD under Part 4 of the EP&A Act that triggers the Biodiversity Offset Scheme (BOS) must be accompanied by a BDAR prepared by an accredited assessor in accordance with the BAM.
Biodiversity Conservation Regulation 2017 (BC Regulation)	DPE	The BC Regulation commenced on 25 August 2017. The object of the BC Regulation is to make provision for matters that are required or authorised to be prescribed as a consequence of the enactment of the BC Act. The BC Regulation provides the thresholds which trigger the BOS, the principles for consideration of serious and irreversible biodiversity impacts, rules for meeting a biodiversity offset obligation, biodiversity certification criteria, additional biodiversity impacts to which the scheme applies and compliance provisions for unauthorised clearing and accredited assessors. This BDAR has been prepared in accordance with the provisions of the BC Regulation.
National Parks and Wildlife Act 1974 (NPW Act)	DPE	The NPW Act provides for the protection of Aboriginal sites and designated conservation areas as well as the flora and fauna within conservation areas. The objective of the NPW Act is to consolidate and amend the law relating to the establishment, preservation and management of national parks, historic sites, certain other areas, and the protection of certain fauna, native plants and Aboriginal objects. Goulburn River National Park, listed under the NPW Act, surrounds the Project Area.

Relevant legislation	Governing Agency	Summary
Fisheries Management Act 1994 (FM Act)	Department of Primary Industries (DPI)	The objectives of the FM Act are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. More detailed objectives relevant to the Project include: • to conserve fish stocks and key fish habitats • to conserve threatened species, populations and ecological communities of fish and marine vegetation • to promote ecologically sustainable development, including the conservation of biological diversity. An Aquatic Assessment which includes an assessment of the likely impacts on listed aquatic threatened species, populations and ecological communities under the FM Act is provided in Appendix 7 of the EIS.
Biosecurity Act 2015	DPI	The Biosecurity Act replaced the *Noxious Weeds Act 1993* on 1 July 2017. The Biosecurity Act is a wide-ranging legislation that outlines the requirements of government, councils, private landholders, and public authorities in the management of biosecurity matters. Priority weeds are regulated under the Biosecurity Act with a general biosecurity duty to prevent, eliminate or minimize any biosecurity risk they may pose. Some priority weeds have additional management obligations which may apply generally, or under specific circumstances. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised as is reasonably practicable.
Local Land Services Act 2013 (LLS Act)	Local Land Services (LLS)	The LLS Act, supported by the Local Land Services Regulation 2014 (LLS Regulation), established 11 regional Local Land Services organisations to provide biosecurity, natural resources management and agricultural advisory services. Under Part 5A of the LLS Act and the supporting regulation, a Native Vegetation Regulatory (NVR) map showing the extent of categorised land in NSW is to be published by the Environment Agency Head. The NVR map underpins the legislative framework for native vegetation clearing in rural areas by categorising land in NSW. However, the map applies only to the following zones (if they are not in an excluded LGA): Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone RU5 Primary Production Small Lots and Zone RU6 Transition. Currently, various map categories have been released under staged transitional arrangements. The online NVR map viewer currently displays Excluded Land, Category 2 – Vulnerable Land and Category 2 – Sensitive Land. Category 1 – Exempt Land and Category 2 – Regulated Land maps have not yet been released. During the transition period landholders must determine if their land is Category 1 or Category 2 under the LLS Act. The BAM does not need to be applied to land mapped as Category 1 – Exempt Land. Portions of the Development Footprint have been mapped as Category 1 – Exempt Land on the extract of the Draft Native Vegetation Regulatory map, provided by the NSW Government for this Project.

Relevant legislation	Governing Agency	Summary
State Environmental Planning Policy (Biodiversity and Conservation) 2021	DPE	SEPP (Biodiversity and Conservation) 2021 commenced in March 2022 and includes a number of previous planning policies including Koala Habitat Protection 2019 and Koala Habitat Protection 2021, Chapter 3 and 4, respectively. Schedule 2 identifies that the provisions of chapters 3 and 4 apply in the Upper Hunter LGA. For all RU1 (Primary Production), RU2 (Rural Landscape) or RU3 (Forestry) zoned land outside of the Sydney Metropolitan Area and Central Coast, Chapter 3 Koala Habitat Protection 2020 applies. Chapter 3 aims to encourage the proper conservation and management of areas of natural vegetation that may provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline. This is to be achieved through identifying areas of core Koala habitat, including these areas in environment protection zones and where required managing development consent in relation to areas of core Koala habitat. An assessment of impacts to Koalas under the SEPP (Biodiversity and Conservation) is provided in **Section 5.5**.

1.6 Biodiversity Offsets Scheme Entry

The Biodiversity Offset Scheme (BOS) applies to all SSD Projects and the SEARS require a BDAR to be prepared for the Project in accordance with Section 7.9 of the BC Act. The Development Footprint also includes mapped Biodiversity Values areas on the Biodiversity Values Map, as shown in **Figure 1.4**.



Legend

- Access Points
- Proposed Access Tracks
- Existing Roads and Tracks
- Property Boundaries
- Development Footprint
- Project Area

Biodiversity Values Map (v13.1)

- Threatened Species or Communities with potential for Serious and Irreversible Impacts

FIGURE 1.4

Biodiversity Values Map

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

1.7 Excluded Impacts – NVR Mapping

The BC Act (at Clause 6.8(3)) specifies that the BAM is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on Category 1-Exempt Land (as defined in Part 5A of the Local Land Services Act 2103 (LLS Act)), other than prescribed impacts (as defined in clause 6.1 of the Biodiversity Conservation Regulation 2017 (BC Regulation)).

The NSW Government has undertaken a transitional approach and period to the release of the Native Vegetation Regulatory (NVR) Map which currently includes not releasing final mapping of areas of Category 1 Exempt Land.

The assessment of Category 1 Land under the BAM during this transitional period has been dealt with in BAM Assessor Updates (No. 22 6 September 2019 and No. 3 6 August 2018). The guidance provided identified that accredited assessors were responsible for determining areas of Category 1 Land for developments affecting rural land. These areas were identified as not requiring impact assessment offset calculations relating to vegetation integrity and habitat suitability.

Umwelt initially completed a desktop assessment to determine areas of Category 1 Exempt Land within the Project Area and found that areas of the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions CEEC was represented within areas of Category 1 land within the Development Footprint. These areas were primarily composed of highly degraded grazing paddocks. The LLS Act identifies that Category 1 Exempt Land excludes land mapped by the Environment Agency Head (EAH) as land containing a CEEC under the BC Act. Umwelt identified that no areas of CEEC vegetation mapped by the EAH occurred within the Project Area.

Umwelt's Land Categorisation Assessment Report was sent to the Biodiversity Conservation and Science Division (BCD) within DPE for review on 29 September 2022. A request for the NSW Government's full draft NVR mapping was also forwarded to BCD and the Map Review Team on this date. No correspondence was received in relation to the 29 September 2022 email request or a follow request on 7 November 2022.

During December 2022 the DPE released the guide "*Determining native vegetation land categorisation for application in the Biodiversity Offsets Scheme*". This document updated the NSW Government's advice on Category 1 Land mapping and CEECs, and provides advice that CEECs and critically endangered species of plants are designated as Category 2 – sensitive regulated land (clause 108(2)(b), LLS Regulation), noting that state-wide comprehensive mapping both entities is not currently published, and that a complete a site-based floristic assessment is required to confirm the presence or absence of CEECs and/or critically endangered plants for any reasonable assessment of NVR map land category.

Umwelt submitted another request to the Map Review Team in March 2023 requesting the draft NVR mapping for the Project Area and obtained a raster copy of the map layer on 24 March 2023. A copy of this map is provided as **Figure 1.5**.

For the purposes of this assessment, areas of derived native grassland that meet the final determination of the White Box - Yellow Box - Blakeley's Red Gum Woodland and Derived Native Grassland CEEC listed under the BC Act, have been considered Category 2 – Sensitive Land as per the current advice from DPE. Areas of derived native grassland occurring within areas of Category 1 – Exempt Land as mapped on **Figure 1.5** and which do not conform to a CEEC, have been assessed as Category 1 – Excluded Land.

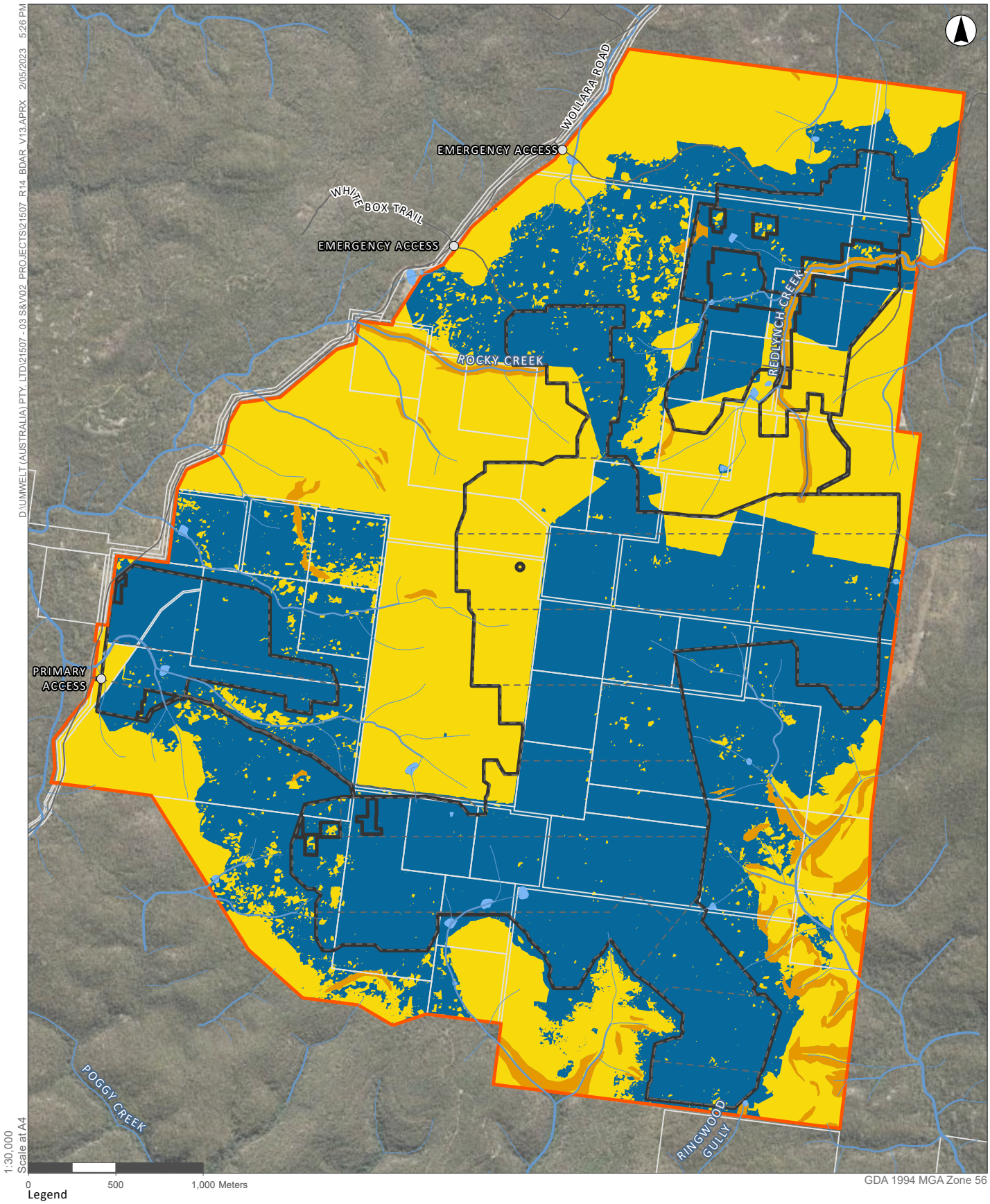


FIGURE 1.5

Draft Native Vegetation Regulatory Map

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022); NSW DPE (2023)

1.8 Matters of National Environmental Significance

The Project has been determined to be a Controlled Action and requires approval under the EPBC Act. DCCEEW have identified that based on the information in the referral documentation, the location of the action, species records and likely habitat in the area, there are likely to be significant impacts to:

- White Box-Yellow Box-Blakley's Red Gum Grassy Woodland and Derived Native Grassland – critically endangered ecological community.
- Regent Honeyeater – critically endangered.

DCCEEW has also identified that there is some risk that there may be significant impacts on the following further matters and further assessment is required to determine if the following communities and species are present in the proposed action area and if so, the extent to which they may be impacted by the proposed action:

- Central Hunter Valley Eucalypt Forest and Woodland – critically endangered
- Swift Parrot (*Lathamus discolor*) – critically endangered.
- Painted Honeyeater (*Grantiella picta*) – vulnerable.
- Large-eared Pied Bat – vulnerable.
- Corben's Long-eared Bat (*Nyctophilus corbeni*) – vulnerable.
- Pink tailed Worm-lizard (*Aprasia parapulchella*) – vulnerable.
- Bluegrass (*Dichanthium setosum*) – vulnerable.
- Homoranthus darwinioides – vulnerable.

DCCEEW has also requested further analysis of the impacts of the 2019–2020 bushfires on the following species as part of this assessment:

- White Box-Yellow Box-Blakley's Red Gum Grassy Woodland and Derived Native Grassland – critically endangered ecological community.
- Regent Honeyeater (*Anthochaera phrygia*) – critically endangered.
- Koala (*Phascolarctos cinereus*) (Combined Population of QLD, NSW and the ACT) – vulnerable.
- Greater Glider (*Petauroides volans*) – vulnerable.
- Brush tailed Rock wallaby (*Petrogale penicillata*) – vulnerable.
- Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (*Dasyurus maculatus maculatus* (South-east mainland population)) – endangered.
- New Holland Mouse, Pookila (*Pseudomys novaehollandiae*) – vulnerable.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – vulnerable.

Table 1.1 in **Section 1.2** details the assessment requirements associated with the Controlled Action determination.

The BAM has been endorsed as the assessment method for Matters of National Environmental Significance under a Bilateral Agreement made under the EPBC Act. The Australian Government is the decision-maker for whether the Project will be approved under the EPBC Act. Nationally listed threatened species, TECs and migratory species have been considered and assessed as part of this BDAR. A separate MNES assessment addressing the requirements of the Project Assessment Notes provided by DCCEEW is included in **Appendix A**.

1.9 Information Sources

The following guidance documents and resources relevant to the preparation of this BDAR were reviewed:

- Biodiversity Assessment Method (NSW DPIE 2020a).
- Biodiversity Assessment Method Operational Manual – Stage 1 (NSW DPIE 2020b).
- Biodiversity Assessment Method Operational Manual – Stage 2 (NSW DPIE 2019).
- Biodiversity Assessment Method (BAM) Calculator User Guide (NSW OEH 2017).
- NSW Bionet including the Bionet Atlas, Bionet Vegetation Database and Threatened Species Data Collection (TBCD) (NSW DPE 2023a).
- Guidance for the Biodiversity Development Assessment Report Template (including the template) (NSW DPE 2022).
- Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment method (NSW DPIE 2020c).
- Flora Species with Specific Survey Requirements List Version 1 (NSW DPIE 2020d).
- 'Species Credits' threatened bats and their habitats (NSW OEH 2018b).
- NSW Survey Guide for Threatened Frogs (NSW DPIE 2020e).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (NSW DEC 2004).

Other information sources relied upon are referenced in the text and are listed in the References Section of this report (**Section 12.0**).

2.0 Methods

2.1 Site Context Methods

2.1.1 Landscape Features

Landscape feature such as Interim Biogeographic Regionalisation for Australia (IBRA) bioregions, IBRA subregions and NSW (Mitchell) Landscape regions, native vegetation extent within a 1500 m buffer area, cleared areas, rivers, streams, wetlands and connectivity features were identified within the Assessment Area where appropriate in accordance with Section 3.1.3 of the BAM (DPIE 2020a). Determination of the 'Site Context' was calculated by assessing the native vegetation cover and patch size within the Development Footprint in accordance with Section 3.2 and Subsection 4.3.2 of the BAM, respectively (DPIE, 2020a).

2.2 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity Methods

2.2.1 Existing Information

The following existing information was reviewed to inform the identification of PCTs (**Section 4.2**) and TECs (**Section 4.3**):

- NSW State Vegetation Type Map: Upper Hunter Version 1.0 (NSW OEH, 2019).
- Notice and Reason for the Final Determination for the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland critically endangered ecological community (NSW Threatened Species Scientific Committee 2020a).
- Conservation Assessment of White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (NSW Threatened Species Scientific Committee 2020b).
- EPBC Act Policy Statement 3.5 – White Box - Yellow Box - Blakely's Red Gum grassy woodlands and derived native grasslands (AGDEH 2006a).
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Ecological Community Species List (AGDEH 2006b).
- Commonwealth Listing Advice on White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland (AGDEH 2006c).

2.2.2 Mapping Native Vegetation Extent

The native vegetation extent within the Development Footprint was determined during site surveys, through Geographic Information Systems (GIS) mapping and aerial photograph interpretation using recent aerial imagery. Native vegetation and PCT mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Footprint. Vegetation mapping involved the following key steps:

- Review of aerial imagery to assess vegetation distribution patterns as dictated by change in canopy texture, tone, and colour, as well as topography.
- Review of the modelled distribution of vegetation communities within broader scale regional based vegetation mapping.
- Preparation of a draft PCT map based on interpretation of digital aerial imagery.
- Field-based ground-truthing of the draft PCT mapping.
- Confirmation of vegetation community floristic delineations based on plot data.

Vegetation communities were delineated through the identification of patterns of plant species assemblages in each of the identified strata. Slight variations in species composition are typical across the extent of a community and are often associated with microhabitats or ecotones with other communities.

The extent of native ground-cover vegetation within offsite areas where a canopy of native trees was absent, was estimated based on the visual interpretation of aerial imagery including areas of cultivation and fence boundaries. Native vegetation extent mapping offsite is broad-scale and completed for the purposes of estimation of native vegetation cover under the BAM (DPE, 2020a).

2.2.3 Plot-Based Vegetation Survey

A stratified plot-based floristic vegetation survey of the Development Footprint was undertaken in accordance with Table 3 and Section 4.2.1 of the BAM to assess the expected environmental variation and address any gaps and verify the results of previous mapping and site information.

The BAM plots were sampled by Umwelt ecologists on the following dates:

- 3 February 2022
- 21–25 March 2022
- 5–7 April 2022
- 15–16 June 2022
- 30 January–2 February 2023.

BAM plot survey stratification for each plant community type is listed in **Table 2.1**.

Table 2.1 Plant Community Type Survey Plot Stratification Details

PCT ID	PCT name	Vegetation Condition Zone	Area (ha)	Quantity of Plots Required (BAM 2020 Table 3)	Plots Completed in 2022/23
483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	Scattered Trees	23.64	4	5
		Moderate Condition Derived Native Grassland	168.48	6	18
		Moderate to Low Condition Derived Native Grassland	308.37	7	19
		Low Condition Derived Native Grassland	199.14	5	10
1661	Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	Scattered Trees	6.07	3	4
		Moderate to Low Condition Derived Native Grassland	36.79	4	11
		Low Condition Derived Native Grassland	53.24	5	5

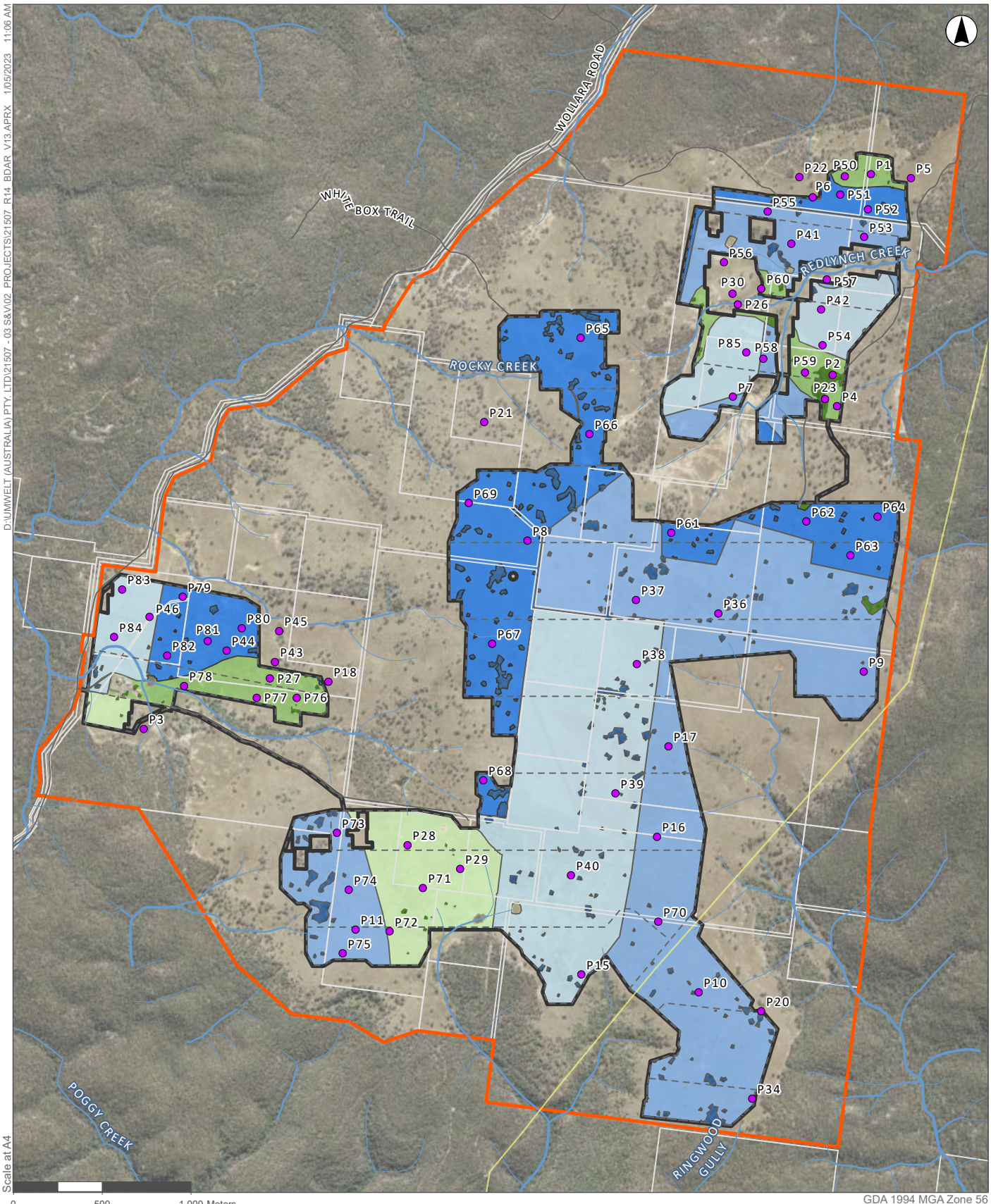
Each BAM plot consisted of a 20x20 m floristic plot nested within each 20x50 m vegetation integrity plot. Plot locations were recorded with a hand-held Global Positioning System (GPS) device and are shown in **Figure 2.1**. All vascular plants recorded within floristic plots were identified using keys and nomenclature in Plantnet NSW Flora Online Identification Keys (The Royal Botanic Gardens and Domain Trust 2023).

The floristic survey data collected included the survey data requirements identified in Table 1 of the BAM. The plot survey effort was completed to ensure compliance with the stratification requirements of Table 3 of the BAM. Plot locations were selected to ensure that they captured attributes relevant to each vegetation condition zone. Plots were established to provide a representative assessment of the vegetation integrity of the vegetation zone, accounting for the level of variation in the broad condition state of the vegetation zone. Plots were positioned to avoid locations on ecotones, tracks (their edges) and/or small disturbed areas generally inconsistent with the target vegetation zone (e.g., small patches of bare ground).

At each plot, approximately 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 m floristic plot. Searches were generally undertaken through parallel transects from one side of the plot to another. Most efforts were spent examining the groundcover, which consistently supported well over half of the species present. The tree canopy and tree trunks were searched for mistletoes, vines, and epiphytes.

2.2.4 Vegetation Integrity Survey

As part of the plot-based vegetation survey, native vegetation composition, structure and function attributes identified in Section 4.3.4 of the BAM were assessed for each BAM plot. The locations of the plots sampled are mapped to scale and shown as BAM Plots in **Figure 2.1**.



Legend

- Proposed Access Tracks
- Existing Roads and Tracks
- Watercourse
- Electricity Transmission Line
- Property Boundaries
- Development Footprint
- Project Area
- BAM Plots

Plant Community Types and Condition Zones

PCT 483 - Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

- Low Condition Derived Native Grassland
- Moderate to Low Condition Derived Native Grassland
- Moderate Condition Derived Native Grassland
- Scattered Trees

PCT 1661 - Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin

- Low Condition Derived Native Grassland
- Moderate to Low Condition Derived Native Grassland
- Scattered Trees

FIGURE 2.1

Field Survey Locations - Vegetation Plots

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

2.3 Threatened Flora Survey Methods

2.3.1 Review of Existing Information

The following existing information was reviewed to inform the threatened flora species surveys and assessment of habitat constraints and microhabitats:

- DPE BAM Calculator (BAM-C) (available online to accredited BAM assessors).
- Threatened flora records held on the NSW BioNet Atlas of NSW Wildlife within the Assessment Area (NSW DPE 2022a).
- Vegetation associations reports for the Sydney Basin IBRA bioregion – Kerrabee IBRA sub-region for each PCT present to determine threatened fauna species PCT associations.
- Habitat constraints listed in the TBDC (NSW DPE 2022c).
- BAM Flora species with specific survey requirements spreadsheet (NSW DPIE 2020d).

2.3.2 BioNet Atlas Threatened Flora Records

Details of the threatened flora species recorded on the BioNet Atlas within 10 km of the Project Area are summarised in **Table 2.2**.

Table 2.2 BioNet Atlas Threatened Flora Records within 10 km

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Records within 10 km	Likelihood of Occurrence	Comments
Commersonia rosea (Androclava rosea)	-	E	E	01/03/2005	1	Low potential for occurrence in PCT 1661 only.	Occurs on skeletal sandy soils in scrub and heath. Recorded on the BioNet Atlas adjacent to Project Area on western side of Wollara Road. No associated PCTs are present within the Development Footprint and the habitats present are not likely to support this species.
Cymbidium canaliculatum	*Cymbidium canaliculatum* population in the Hunter Catchment	E Pop.	-	01/11/2021	50	Moderate potential for occurrence in PCT 483.	Denatured records mapped mostly south of the Goulburn River.
Dichanthium setosum	Bluegrass	V	V	06/06/2019	1	Not likely to occur.	Single record from Merriwa Plain approx. six km north of the Project Area. Not known from within the Sydney Basin Bioregion.
Diuris tricolor	Pine Donkey Orchid	V	-	14/10/2012	114	Low potential for occurrence in PCT 1661 only.	Denatured records mapped mostly south of the Goulburn River, none in close proximity to the Project Area.
Eucalyptus camaldulensis	*Eucalyptus camaldulensis* population in the Hunter catchment	E Pop.	-	01/10/2010	11	Not likely to occur	Local records are south of the Goulburn River, none in close proximity to the Project Area. No associated PCTs present and no habitats present which are likely to support this species.
Homoranthus darwinioides	Fairy Bells	V	V	28/10/2021	49	Moderate potential for occurrence in PCT 1661.	Recorded in the Goulburn River National Park in sandstone habitats adjoining the Project Area

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Records within 10 km	Likelihood of Occurrence	Comments
Ozothamnus tesselatus	-	V	V	23/11/2019	66	Low potential for occurrence	Local records are south of the Goulburn River and the Project Area is considered to be outside of this species range.
Pomaderris queenslandica	Scant Pomaderris	E	-	03/11/2014	5	Moderate potential for occurrence in PCT 1661.	Local records are south and north-west of the Project Area.
Tylophora linearis		V	E	05/09/2014	1	Not likely to occur.	One record south of the Goulburn River, no records directly adjacent to the Project Area.

2.3.3 Habitat Constraints Assessment

The following field-based surveys were undertaken to assess the habitat constraints for the candidate threatened flora species:

- Field searches for habitat constraints identified from the desktop review of the TBDC.
- Direct observation of the quality and suitability of micro-habitats present.
- Collection of rapid flora assessments for each PCT to assess the condition of the habitats present on 9–12 August 2021.
- Collection of site photographs to assess the condition of habitats present.

The results of the site-based habitat constraints assessment were utilised to inform the assessment of the confirmed candidate threatened species assessment in the BAM-C. Where species presence could not be ruled out in accordance with Section 5.2 of the BAM, surveys were conducted. The species credit species predicted to occur on the Development Footprint and justifications for ruling species out from further survey and assessment are identified in **Table 5.2** in **Section 5.1.2.1** and **Table 5.3** in **Section 5.1.2.2** below.

2.3.4 Field Surveys

Searches for threatened flora species were completed in accordance with the NSW Survey Guide, '*Surveying threatened plants and their habitats'* (DPIE 2020c) and any relevant species requirements listed in the TBDC (NSW DPE 2022a). Details of the field survey methods used and species targeted are listed in **Table 2.3** and the locations of the surveys completed are mapped in **Figure 2.2**.

Surveys for threatened flora were completed within the following PCTs:

- PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley.
- PCT 1607 Blakely's Red Gum - Narrow-leaved Ironbark - Rough-barked Apple shrubby woodland of the upper Hunter.
- PCT 1661 Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin.
- PCT 1655 Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin.

Impacts to PCT 1607 and PCT 1655 were avoided through design changes which were implemented following the completion of surveys and these PCTs are now outside of the Development Footprint.

Survey groups 1 and 2 were surveyed on the same dates. The traverses for these survey groups have not been mapped separately, however a 10 m wide parallel traverse was applied for Group 1 and a 20 m parallel traverse was applied for Group 2 species.

Grid-based searches were completed for Survey Group 5 over an area of >50 ha. The grid-based searches were targeted to areas with preferred microhabitats for *Cymbidium canaliculatum. Cymbidium canaliculatum* is an epiphytic orchid species which takes advantage of the decaying heartwood of eucalypt trees. Searches for this species targeted substrates such as stumps, logs and trees providing potential habitat.

Monotaxis macrophylla was also targeted during habitat searches on a precautionary basis, however it is considered that the Development Footprint is too disturbed to support this species. *Monotaxis macrophylla* is a 'fire ephemeral' species associated with rocky ridge and hillside microhabitats in a diversity of associated vegetation types (DPE 2023). The BioNet Atlas identifies that the species should be targeted for surveys within six months of disturbance by fire as it is a short-lived annual, and will not be present unless a recent disturbance/fire event has occurred and triggered germination. BioNet Atlas strongly recommends expert report to discount presence or absence, or detection by soil seed analysis. It is considered that the microhabitats required are not present (rocky ridges) and the Development Footprint is too degraded to support this species due to historical clearing, pasture improvement and altered fire regimes. This species is fire dependent and fire has been largely excluded from the Development Footprint through fuel load reduction associated with the ongoing agricultural use of the site.

Table 2.3 Candidate Threatened Flora Species Targeted and Field Survey Methods Used

Survey Group	Target Species	Species Survey Period	Survey Dates	Survey Method	Areas Surveyed by PCT Association and/or Habitat Suitability	
					483	1661
Group 1	*Diuris tricolor**	September–October	13–14 October 2021	10 m parallel traverse	-	x Surveyed within areas of lower disturbance including the Scattered Trees and parts of the Moderate to Low Derived Native Grassland condition zones)
Group 2	*Ozothamnus tesselatus* *	September–October	13–14 October 2021	20 m parallel traverse	-	x (Scattered trees and Moderate to Low Derived Native Grassland conditions zones where shrubs were present)
	Monotaxis macrophylla	August–February	13–14 October 2021	20 m parallel traverse	-	x (Scattered trees and Moderate to Low Derived Native Grassland conditions zones where shrubs were present)
Group 3	*Homoranthus darwinioides**	March–December	23 November 2021	10 m parallel traverse	-	x (Scattered trees and Moderate to Low Derived Native Grassland conditions zones where shrubs were present)
	Pomaderris queenslandica	All year	23 November 2021	10 m parallel traverse	-	x (Scattered trees and Moderate to Low Derived Native Grassland conditions zones where shrubs were present)

Survey Group	Target Species	Species Survey Period	Survey Dates	Survey Method	Areas Surveyed by PCT Association and/or Habitat Suitability	
					483	1661
Group 4	*Cymbidium canaliculatum**	All year	31 January 2022 2 February 2022	20 m parallel traverse	-	x (Scattered trees condition zone)
Group 5	*Cymbidium canaliculatum**	All year	7–10 February 2022	Phase 1 grid-based search	x (Scattered trees condition zone)	-
	Monotaxis macrophylla	August–February	7–10 February 2022	Phase 1 grid-based search	x Precautionary survey only, Development Footprint assessed as too disturbed to support this species. (Moderate and Moderate to Low Derived Native Grassland Condition Zones and Scattered Trees Condition Zone where surrounded by the above zones)	x (Low Condition Derived Native Grassland)
Group 6	*Monotaxis macrophylla*	August–February	31 January 2022 2, 7–8 February 2022	20 m parallel traverse	-	x Precautionary survey only, Development Footprint assessed as too disturbed to support this species. (Scattered trees and Moderate to Low Derived Native Grassland conditions zones where shrubs were present)

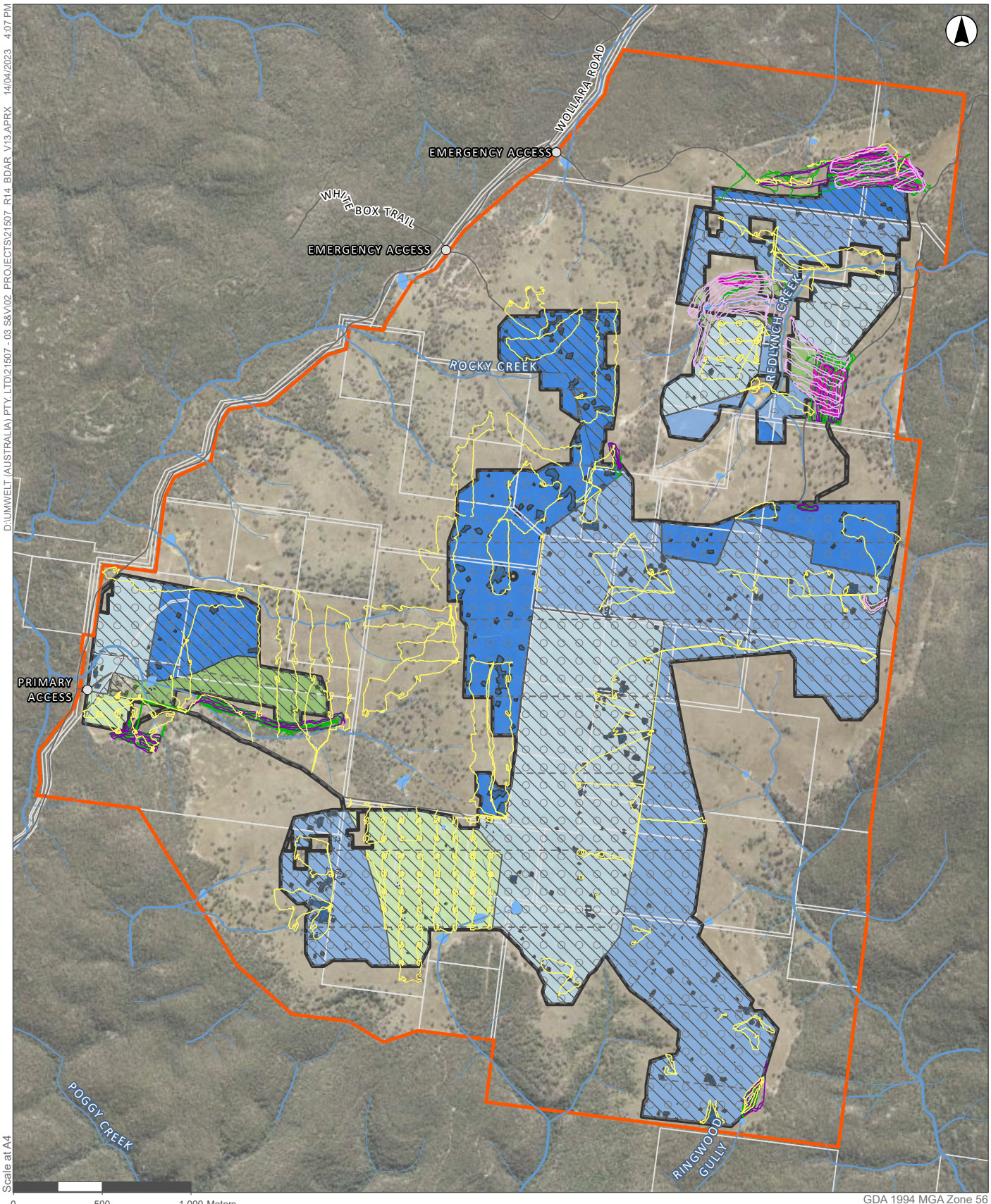
Survey Group	Target Species	Species Survey Period	Survey Dates	Survey Method	Areas Surveyed by PCT Association and/or Habitat Suitability	
					483	1661
	*Commersonia rosea**	All year	31 January 2022 2, 7–8 February 2022	10 m parallel traverse	-	x (Scattered trees and Moderate to Low Derived Native Grassland conditions zones where shrubs were present)
	*Cymbidium canaliculatum**	All year	31 January 2022 2, 7–8 February 2022	10 m parallel traverse	-	x (Scattered Trees Condition Zone)

KEY TO SYMBOLS

x = Survey completed in PCT

Blank cells = Non-associated PCT / targeted survey for species not completed in PCT as no suitable habitat present

* = Species not associated with PCTs in BAM-C



Legend

- Access Points
- Proposed Access Tracks
- Existing Roads and Tracks
- Watercourse
- Waterbodies
- Property Boundaries
- Phase 1 Grid Search Circles
- Development Footprint
- Project Area

Threatened Flora Survey Transects

- Group 1 and 2
- Group 3
- Group 4
- Group 5
- Group 6

Draft Native Vegetation Regulatory Map

- Category 1 - exempt land

Plant Community Types and Condition Zones

PCT 483 - Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

- Low Condition Derived Native Grassland
- Moderate to Low Condition Derived Native Grassland
- Moderate Condition Derived Native Grassland
- Scattered Trees

PCT 1661 - Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin

- Low Condition Derived Native Grassland
- Moderate to Low Condition Derived Native Grassland
- Scattered Trees

FIGURE 2.2

Field Survey Locations - Threatened Flora Surveys

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

2.4 Threatened Fauna Survey Methods

2.4.1 Review of Existing Information

The following existing information was reviewed to inform the threatened fauna species surveys and assessment of habitat constraints and microhabitats:

- BAM-C (available online to accredited BAM assessors).
- Threatened fauna records held on the NSW BioNet Atlas of NSW Wildlife within the Assessment Area (NSW DPE 2023a).
- Vegetation associations reports for the Sydney Basin IBRA bioregion – Kerrabee IBRA sub-region for each PCT present to determine threatened fauna species PCT associations.
- Habitat constraints listed in the TBDC (DPE 2023c).

2.4.2 BioNet Atlas Threatened Fauna Records

Details of the threatened fauna species recorded on the BioNet Atlas within 5 km of the subject land are summarised in **Table 2.4**. Fauna species with a moderate or high potential to occur have been included for further assessment as either ecosystem credit, species credit or dual credit entities.

Table 2.4 BioNet Atlas Threatened Fauna Records within 10 km

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Records	Likelihood of Occurrence
Anthochaera phrygia	Regent Honeyeater	Critically Endangered	Critically Endangered	5/11/2019	73	Foraging habitat use: high, Breeding habitat use: low
Aprasia parapulchella	Pink-tailed Legless Lizard	Vulnerable	Vulnerable	11/12/2000	1	Low to moderate
Artamus cyanopterus cyanopterus	Dusky Woodswallow	Vulnerable	-	4/08/2021	94	Observed
Callocephalon fimbriatum	Gang-gang Cockatoo	Vulnerable	Endangered	3/09/2011	7	Moderate
Calyptorhynchus lathami	Glossy Black-Cockatoo	Vulnerable	Vulnerable	21/10/2020	69	Observed
Chalinolobus dwyeri	Large-eared Pied Bat	Vulnerable	Vulnerable	7/4/2022	35	High
Chthonicola sagittata	Speckled Warbler	Vulnerable	-	24/02/2022	198	High
Circus assimilis	Spotted Harrier	Vulnerable	-	23/05/2019	4	High
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	Vulnerable	-	15/03/2022	295	High
Daphoenositta chrysoptera	Varied Sittella	Vulnerable	-	21/10/2020	57	High
Dasyurus maculatus	Spotted-tailed Quoll	Vulnerable	Endangered	1/07/2004	1	Low, single record south of Goulburn River
Falco subniger	Black Falcon	Vulnerable	-	8/01/2019	2	Moderate
Falsistrellus tasmaniensis	Eastern False Pipistrelle	Vulnerable	-	11/12/2000	1	Low
Glossopsitta pusilla	Little Lorikeet	Vulnerable	-	15/03/2022	142	Observed
Grantiella picta	Painted Honeyeater	Vulnerable	Vulnerable	22/10/2019	14	High
Haliaeetus leucogaster	White-bellied Sea-Eagle	Vulnerable	-	22/09/2015	4	Not likely to occur
Hieraaetus morphnoides	Little Eagle	Vulnerable	-	2/10/2020	10	Moderate
Hirundapus caudacutus	White-throated Needletail	-	Vulnerable	19/02/2021	9	Observed

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Records	Likelihood of Occurrence
Lathamus discolor	Swift Parrot	Endangered	Critically Endangered	14/05/2005	2	Low to moderate potential of occasional occurrence
Leipoa ocellata	Malleefowl	Endangered	Vulnerable	19/12/1989	2	Low
Lophoictinia isura	Square-tailed Kite	Vulnerable	-	4/10/2008	3	Moderate
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	Vulnerable	-	3/11/2020	52	High
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	Vulnerable	-	1/10/2019	53	High
Miniopterus australis	Little Bent-winged Bat	Vulnerable	-	4/03/2010	2	High
Miniopterus orianae oceanensis	Large Bent-winged Bat	Vulnerable	-	7/04/2022	46	High
Neophema pulchella	Turquoise Parrot	Vulnerable	-	2/10/2020	58	High
Ninox connivens	Barking Owl	Vulnerable	-	3/11/2020	18	Observed
Ninox strenua	Powerful Owl	Vulnerable	-	11/06/2016	10	Moderate
Nyctophilus corbeni	Corben's Long-eared Bat	Vulnerable	Vulnerable	25/02/2010	3	Low
Petrogale penicillata	Brush-tailed Rock-wallaby	Endangered	Vulnerable	19/05/2010	3	Low
Petroica boodang	Scarlet Robin	Vulnerable	-	29/06/2018	12	High
Petroica phoenicea	Flame Robin	Vulnerable	-	26/02/2010	1	High
Phascolarctos cinereus	Koala	Endangered	Endangered	2/10/2016	7	Low (record marked on site from 1957 with questionable locational accuracy). Recent call, scat and scratching records are 5 km SW on alluvial flats associated with the Goulburn River.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Records	Likelihood of Occurrence
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	Vulnerable	-	22/10/2019	13	High
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	Vulnerable	-	3/03/2010	3	Moderate
Scoteanax rueppellii	Greater Broad-nosed Bat	Vulnerable	-	4/03/2010	7	Moderate
Stagonopleura guttata	Diamond Firetail	Vulnerable	-	15/03/2022	123	Observed
Tyto novaehollandiae	Masked Owl	Vulnerable	-	27/09/2020	3	Low
Vespadelus troughtoni	Eastern Cave Bat	Vulnerable	-	28/03/2022	12	High

2.4.3 Habitat Constraints Assessment

Field-based searches were undertaken to assess the habitat constraints for the candidate threatened fauna species. These searches included observation of habitat constraints identified from the desktop review of the TBDC and recording of the presence, quality and/or suitability of micro-habitats present including:

- hollow bearing trees, particularly those of suitable size for threatened cockatoo and owl breeding habitat
- Koalas use trees
- aquatic habitats suitable for amphibians
- rocky habitats suitable for reptiles
- outcrops, caves, tunnels and old buildings suitable for threatened microbat species.

The results of the site-based habitat constraints assessment were utilised to inform the assessment of the confirmed candidate threatened species assessment in the BAM-C. Where species presence could not be ruled out in accordance with Section 5.2 of the BAM, surveys were conducted.

2.4.4 Fauna Surveys

2.4.4.1 Fauna Survey Guidelines

Targeted surveys for candidate threatened fauna species were completed with reference to the following:

- NSW BioNet Atlas incorporating the Threatened Biodiversity Data Collection (NSW DPE 2022a).
- NSW Survey Guide for Threatened Frogs, A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (NSW DPIE 2020e).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, NSW Department of Environment and Conservation (NSW DEC 2004).
- 'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method, Office of Environment and Heritage (NSW OEH 2018b).
- Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DEWHA 2010a).
- Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DSEWPC 2011).
- Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DEWHA 2010b).

- Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DEWHA 2010c).
- Camera Trapping: wildlife management and research (Meek and Fleming 2014).

2.4.4.2 Diurnal Fauna Surveys

The following methods were utilised for targeted diurnal fauna surveys:

- Nest site searches for candidate raptor species.
- Searches for threatened cockatoo feeding and breeding trees.
- Searches and assessment of potential threatened owl nest trees.
- Searches for microbat roots and ultrasonic call recording.
- Amphibian habitat searches and call playback.
- Opportunistic observation.
- The details of diurnal fauna surveys completed are provided in **Table 2.5** and fauna survey locations are mapped in **Figure 2.3**.

Table 2.5 Details of Diurnal Threatened Fauna Surveys Completed

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
09/08/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	5–18°C, light ESE breeze, no rain.	6.25 hrs x 2 persons / 1015–1630
10/08/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	2–21°C, light WNW breeze, no rain.	9.5 hrs x 2 people / 0730–1700
11/08/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	3–23°C, light WNW breeze, no rain.	9.25 hrs x 2 people / 0730–1645

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
12/08/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	12–20°C, light WNW breeze, no rain.	6.75 hrs x 2 people / 0745–1430
23/08/21	• Targeted diurnal census. • Avifauna, breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	7–21°C, light NNW breeze, no rain.	4.5 hrs x 2 people / 1300–1730
24/08/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	7–10°C, light WNW wind 11.6 mm rain.	4.5 hrs x 2 people / 1200–1630
25/08/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	3–15°C, WNW wind, 4.4 mm rain in the morning.	5 hrs x 2 people / 1230–1730
26/08/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Barking Owl Powerful Owl Masked Owl	1–18°C, WSW breeze, no rain.	4 hrs x 2 people / 1030–1430
21/09/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Square-tailed Kite Barking Owl	15°C, WSW breeze, no rain.	7.5 hrs x 2 people / 1000–1730
22/09/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Glossy Black-Cockatoo Little Eagle Square-tailed Kite Barking Owl	10–20°C, NW breeze, no rain.	7.5 hrs x 2 people / 0700–1430
13/10/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Gang-gang Cockatoo Little Eagle Square-tailed Kite Barking Owl	10–20°C, ESE breeze, no rain.	10 hrs x 2 people / 1000–2000

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
14/10/21	• Targeted diurnal census. • Avifauna breeding activity, stick nest and tree hollow search.	Gang-gang Cockatoo Little Eagle Square-tailed Kite Barking Owl	15–20°C, SSE breeze, no rain.	3.5 hrs x 2 people / 0800–1130
23/11/21	• Reptile rock-rolling searches. • Opportunistic observation of avifauna breeding activity.	Pink-tailed Legless Lizard Striped Legless Lizard Gang-gang Cockatoo Square-tailed Kite Barking Owl	14–25°C, ESE breeze, no rain.	6 x rock rolling searches of ≈ 200 rocks per search 10.5 hrs x 2 people / 0830–1900
24/11/21	• Reptile rock-rolling searches. • Avifauna breeding activity, stick nest and tree hollow search.	Pink-tailed Legless Lizard Striped Legless Lizard Gang-gang Cockatoo Square-tailed Kite Barking Owl	16–26°C, WNW breeze, 1 mm rain.	2 x rock rolling searches of ≈ 200 rocks per search 8.75 hrs x 2 people / 0745–1630
7/12/21	• Avifauna breeding activity, stick nest and tree hollow search.	Gang-gang Cockatoo Square-tailed Kite Barking Owl	15–26°C, WNW breeze, 2.8 mm rain with evening thunderstorms	3 hrs x 2 people / 1700–2000
8/12/21	• Avifauna breeding activity, stick nest and tree hollow search.	Gang-gang Cockatoo Square-tailed Kite Barking Owl	14–28°C, SSW moderate to strong wind, 12.2 mm rain with intermittent thunderstorm.	7 hrs x 2 people / 1300–2000
9/12/21	• Avifauna breeding activity, stick nest and tree hollow search.	Gang-gang Cockatoo Square-tailed Kite Barking Owl	12–25°C, WNW breeze, 58 mm rain (fine during survey but heavy rainfall night prior).	3.5 hrs x 2 people / 0900–1230
31/01/22	Opportunistic observation.	All threatened fauna species	15–33°C, SSE breeze, no rain.	2.25 hrs x 2 people / 1445–1700
1/02/22	Opportunistic observation.	All threatened fauna species	16–32°CW breeze, no rain.	10.5 hrs x 2 people / 0730–1800
2/02/22	Opportunistic observation.	All threatened fauna species	20–25°C, SE breeze, overcast with 0.4 mm rain.	6.5 hrs x 2 people / 0730–1400
3/02/22	BAM plots / Opportunistic observation.	All threatened fauna species	16–23°C, light ESE breeze, 2.4 mm rain.	9.5 hrs x 2 people / 0800–1730

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
7/02/22	Opportunistic observation.	All threatened fauna species	12–15°C, E breeze, 0.2 mm rain with late afternoon thunderstorm.	9 hrs x 2 people / 1000–1900
8/02/22	Opportunistic observation.	All threatened fauna species	10–26°C, ESE breeze, 0.2 mm rain.	11 hrs x 2 people / 0700–1800
9/02/22	Opportunistic observation.	All threatened fauna species	7–30°C, SSW breeze, no rain.	11 hrs x 2 people / 0700–1800
10/02/22	Opportunistic observation.	All threatened fauna species	10–34°C, light S breeze, no rain.	9.5 hrs x 2 people 0700–1630
10/03/22	Opportunistic observation.	All threatened fauna species	13–22°C, E breeze, no rain.	12 hrs x 2 people / 0630–1830
21/03/22	BAM plots / Opportunistic observation.	All threatened fauna species	12–26°C, E breeze, no rain.	1.5 hrs x 2 people / 1530–1700
22/03/22	BAM plots / Opportunistic observation.	All threatened fauna species	10–30°C, WNW wind, no rain.	9 hrs x 2 people / 0730–1630
23/03/22	BAM plots / Opportunistic observation.	All threatened fauna species	13–30°C, ESE breeze, no rain.	9 hrs x 2 people / 0730–1630
24/03/22	BAM plots / Opportunistic observation.	All threatened fauna species	17–22°C, ESE breeze, no rain.	9 hrs x 2 people / 0730–1630
25/03/22	BAM plots / Opportunistic observation.	All threatened fauna species	15–23°C, ESE breeze, no rain.	2.5 hrs x 2 people / 0730–1000
5/04/22	BAM plots / Opportunistic observation.	All threatened fauna species	15–21°C, ESE breeze, no rain.	9.25 hrs x 2 people / 0730–1645
6/04/22	BAM plots / Opportunistic observation.	All threatened fauna species	11–21°C, SE breeze, overcast, no rain.	10 hrs x 2 people / 0730–1730
7/04/22	BAM plots / Opportunistic observation.	All threatened fauna species	17–20°C, SE breeze, no rain.	9.5 hrs x 2 people / 0730–1700
7/04/22	Threatened amphibian aural-visual search transects and call playback survey.	Red-crowned Toadlet	17–20°C, SE breeze, light drizzle.	2 x transects of ≈500 m completed by 2 people 1800–2000
15/06/22	Avifauna breeding activity and hollow search.	Powerful Owl Masked Owl Barking Owl	17°C, WNW breeze, no rain.	5 hrs x 2 people / 1200–1700
16/06/22	Avifauna breeding activity and hollow search.	Powerful Owl Masked Owl Barking Owl	5–19°C, NW breeze, no rain.	5 hrs x 2 people / 0745–1245

2.4.4.3 Nocturnal Fauna Surveys

The following methods were utilised for targeted nocturnal fauna surveys:

- spotlighting and stag-watching searches
- amphibian habitat searches
- quiet listening for candidate threatened fauna calls
- targeted call playback.

Details of these surveys are provided in **Table 2.6**.

Table 2.6 Details of Nocturnal Threatened Fauna Surveys Completed

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
23/08/21	Quiet listening Call playback x2 Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl Masked Owl Powerful Owl	10°C, light E wind, no rain.	2.75 hrs x 2 people 1730–2015
25/08/21	Quiet listening Call playback x3 Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl Masked Owl Powerful Owl	15-5°C, WNW wind, no rain during surveys.	4.25 hrs x 2 people 1730–2145
30/08/21	Quiet listening Call playback x3 Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl Masked Owl Powerful Owl	10-5°C, fine, no wind, recent rain	4.5 hrs x 2 people 1700–2130
13/10/21	Quiet listening Stag Watching Call playback x1 Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl	10°C, fine, ESE breeze, no rain.	1 hr x 2 people 1900–2000
23/11/21	Quiet listening Stag Watching Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl	16°C, overcast, ESE breeze, no rain (prior rain on 20-22/11/21)	1.5 hrs x 2 people 2000–2130

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
7/12/21	Quiet listening Stag Watching Call playback x4 Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl	15°C, overcast, WNW wind, high humidity with thunderstorm during evening	3 hrs x 2 people 2000–2300
8/12/21	Quiet listening Stag Watching Call playback x4 Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl	15°C, SSW winds, intermittent thunderstorms	1.5 hrs x 2 people 2000–2130
2/02/22	Spotlighting and general amphibian survey	Opportunistic spotlighting	18°C, overcast, SE breeze, no rain (prior rain on 26-28/01/22).	1 x ≈500 m transect completed by 2 people over 1.5 hrs 2000–2130
6/04/22	Spotlighting and general amphibian survey	Opportunistic spotlighting	20°C, overcast, SE breeze, no rain (prior rain on 2/04/22).	1 x ≈500 m transect completed by 2 people over 2 hrs 1800–2000
15/06/22	Quiet listening Stag Watching Call playback x 4 Spotlighting	Koala Greater Glider Squirrel Glider Barking Owl Masked Owl Powerful Owl	10-5°C, fine, WNW breeze, no rain.	5 hrs x 2 people 1630–2130

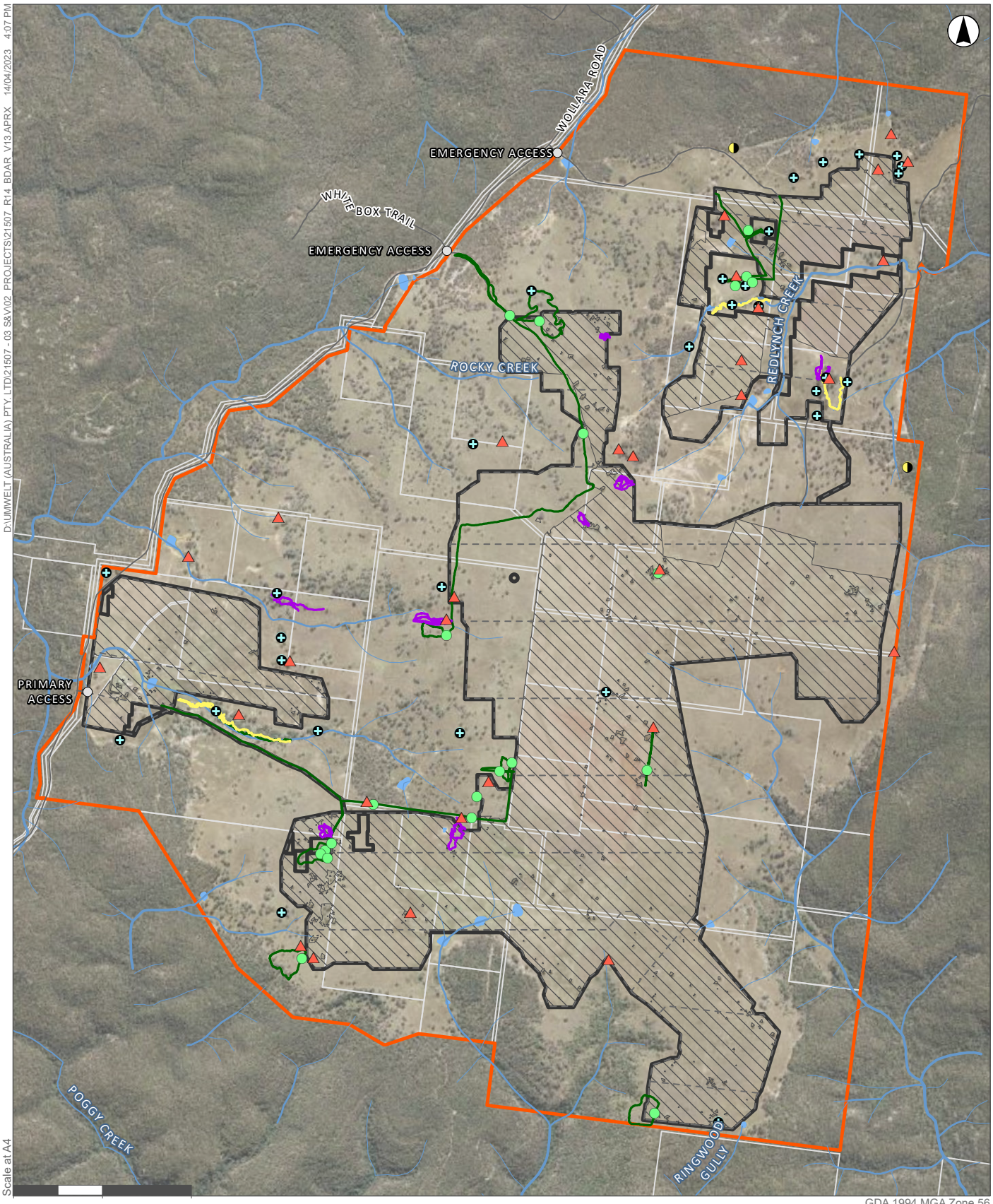
2.4.4.4 Remote Detection Fauna Surveys

The following methods were utilised for the completion of targeted fauna remote detection surveys:

- Arboreal baited remote camera surveys
- Ultrasonic microbat call recording.
- Details of these surveys are provided in **Table 2.7**.

Table 2.7 Details of Remote Detection Threatened Fauna Surveys Completed

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
1/02/2022–10/03/2022 (rebaited 9/02/2022)	Arboreal baited remote triggered camera survey	All threatened mammals (Koala, Greater Glider, Squirrel Glider)	variable	1080 camera trap nights (30 cameras x 36 nights)
13/12/2021 - 26/12/2022	Ultrasonic microbat call detection (Anabat)	Large-eared Pied-bat Eastern Cave Bat	Variable (Min temp = 9.1°C, 4 nights with rainfall >0.2 m)	18 recording nights with 2 Anabats (1 unit x 4 nights, 1 unit x 14 nights)



Legend

- Access Points
- Proposed Access Tracks
- Existing Roads and Tracks
- Watercourse
- Waterbodies
- Property Boundaries
- Development Footprint
- Project Area

Draft Native Vegetation Regulatory Map

- Category 1 - exempt land

Threatened Fauna Surveys

- Diurnal Bird Survey Locations (30)
- Call Playback Locations (21)
- Anabat Locations (2)
- Camera Locations (30)
- Reptile Rock Roll Searches
- Nocturnal Spotlight Survey Transects
- Amphibian Survey Transects

FIGURE 2.3

Field Survey Locations - Threatened Fauna Surveys

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

2.5 Threatened Fungi

No threatened fungi species were identified as predicted or candidate threatened species.

2.6 Weather Conditions

All flora surveys were completed during suitable weather conditions. The weather conditions during fauna surveys are listed in **Table 2.5**, **Table 2.6** and **Table 2.7**.

2.7 Limitations

The surveys completed were undertaken during the appropriate seasons specified within the TBDC to maximise the probability of detection. Some candidate threatened flora species which require fire for germination were surveyed as a precaution and it is considered that grazing and clearing have resulted in the disruption of natural fire regimes and the site is too disturbed to support these species.

BAM Plot surveys were also completed mostly during warmer months to ensure that both perennial and annual species were sampled within grassland plots.

All surveys for candidate threatened flora species consisted of multi-species searches in groups according to detection period and stratum as indicated in **Table 2.3**. These surveys were limited to a maximum of five species per group and the same stratum to overcome limitations associated with species detection.

The surveys for Koalas for this assessment were completed prior to the release of the Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide on 17 June 2022 (NSW DPE 2022b). The BCD BOS Help Desk Team were consulted in June 2022 via email regarding the new survey guidelines and advised that:

> *If the Department publishes new or amend existing survey guides to support the application of the BAM, assessors are expected to apply these to all assessments for which the survey component has yet to be completed, and to all new assessments that commence on, or after the publication date. This is to ensure that your biodiversity assessment reports (BAR) meet the requirements of BAM s6.5.1.3. (BAM 2020 5.3(2.b.).*
>
> *Where survey has been completed prior to the publication of a survey guide, the Department expects the assessor (or surveyor) to have applied current best-practice in searching for the target species (in accordance with BAM s6.5.1.4). Assessors can use information from other published, peer-reviewed sources to guide survey technique and effort, but this must be clearly documented and justified in the BAR as well as indicating how this differs from our recently published guide*.

Koala surveys for this Project were undertaken in accordance with the best practice methods at the time the surveys were completed. The methods utilised for the detection of Koalas for this assessment consisted of spotlighting (8 nights) and remote baited arboreal camera surveys (1080 camera trap nights). Survey methods within the new guidelines (NSW DPE 2022b) which were not utilised included scat search surveys, use of Koala detection dogs, call recording and thermal drone surveys.

3.0 Site Context

3.1 Assessment Area

The Assessment Area, which includes the Development Footprint and the area of land within a 1500 m buffer zone is shown on the Location Map in **Figure 1.2**.

3.2 Landscape Features

Landscape features identified within the Development Footprint are shown on the Site Map provided as **Figure 1.1** and landscape features in the Assessment Area are shown on the Location Map provided as **Figure 1.2**. Further information on landscape features is provided in **Sections 3.2.1** to **Sections 3.2.7**.

3.2.1 IBRA Bioregions and IBRA Subregions

The Development Footprint is located within the Sydney Basin IBRA bioregion and Kerribee IBRA subregion.

3.2.2 Rivers, Streams, Estuaries and Wetlands

The locations of the streams within the Development Footprint are shown on the Site Map provided as **Figure 1.1** and the locations of streams and rivers within the Assessment Area are shown on the Location Map provided as **Figure 1.2**.

There are several first and second order streams within the Development Footprint. One third order watercourse associated with Redlynch Creek did fall within one iteration of the Development Footprint but has subsequently been excluded. All watercourses within or immediately outside the Development Footprint flow into the Goulburn River. There are no estuaries or wetlands located within or adjacent to the Development Footprint or the Project Area. The Project Area is within the Goulburn River Catchment which joins the Hunter River near Denman. The Ramsar listed Hunter Estuary Wetlands – Kooragang Nature Reserve is approximately 160 km downstream of the Project Area as shown in **Figure 3.1**.

3.2.3 Habitat Connectivity

The Development Footprint contains agricultural land, predominantly comprised of grazed grasslands with remnant trees. It is surrounded by the Goulburn River National Park. Patches of retained forest and woodland vegetation are present typically in areas surrounding watercourses and on steeper or less fertile rocky habitats.

The Development Footprint contains three polygons which are separated by proposed vehicle access tracks, as shown in **Figure 3.2**. The three polygons which form the Development Footprint will be protected with fauna exclusion fencing, however the vehicle tracks will not be fenced to prevent habitat fragmentation and ensure that access for terrestrial fauna species is maintained through the Project Area.

The Goulburn River National Park contains an expanse of native vegetation and connects regionally to several other large natural areas managed for conservation along the Great Dividing Range, including Wollemi and Yengo National Parks to the south, Goonoo State Conservation Area to the west and Coolah Tops National Park to the north.

3.2.4 Karst, Caves, Crevices, Cliffs, Rocks or Other Geological Features of Significance

No karst, caves, crevices, cliffs, rocks or other geological features of significance were observed within the Development Footprint. Review of aerial imagery has identified the presence of rock areas and small cliffs outside of the Development Footprint, within the Assessment Area. These rocky habitats are mapped in **Figure 3.2**.

3.2.5 Areas of Outstanding Biodiversity Value

The Development Footprint and Assessment Area do not contain any Areas of Outstanding Biodiversity Value (AOBV) (formerly critical habitat), as identified under the BC Act.

3.2.6 NSW (Mitchell) Landscapes

The Development Footprint is mapped as occurring within the Liverpool Range Valleys and Footslopes NSW (Mitchell) Landscape.

3.2.7 Additional Landscape Features Identified in the SEARS

There are no specific additional landscape features identified for assessment in the SEARs.

3.3 Native Vegetation Cover

The native vegetation cover within the Assessment Area was determined through site surveys of the Development Footprint and aerial photograph interpretation using ArcMap software and the world imagery base map aerial dated 9 August 2018.

Table 3.1 summarises the extent of native vegetation cover within the assessment area and **Figure 1.2** shows the extent of native vegetation cover within the assessment area.

Table 3.1 Native Vegetation Cover in the Assessment Circle

Native Vegetation Cover	
1500 m Buffer Assessment Area (ha)	4586.84 ha
Total Area of Native Vegetation Cover (ha)	4569.17 ha
Percentage of Native Vegetation Cover (%)	99.61%
Class (0–10, >10–30, >30–70 or >70%)	>70%

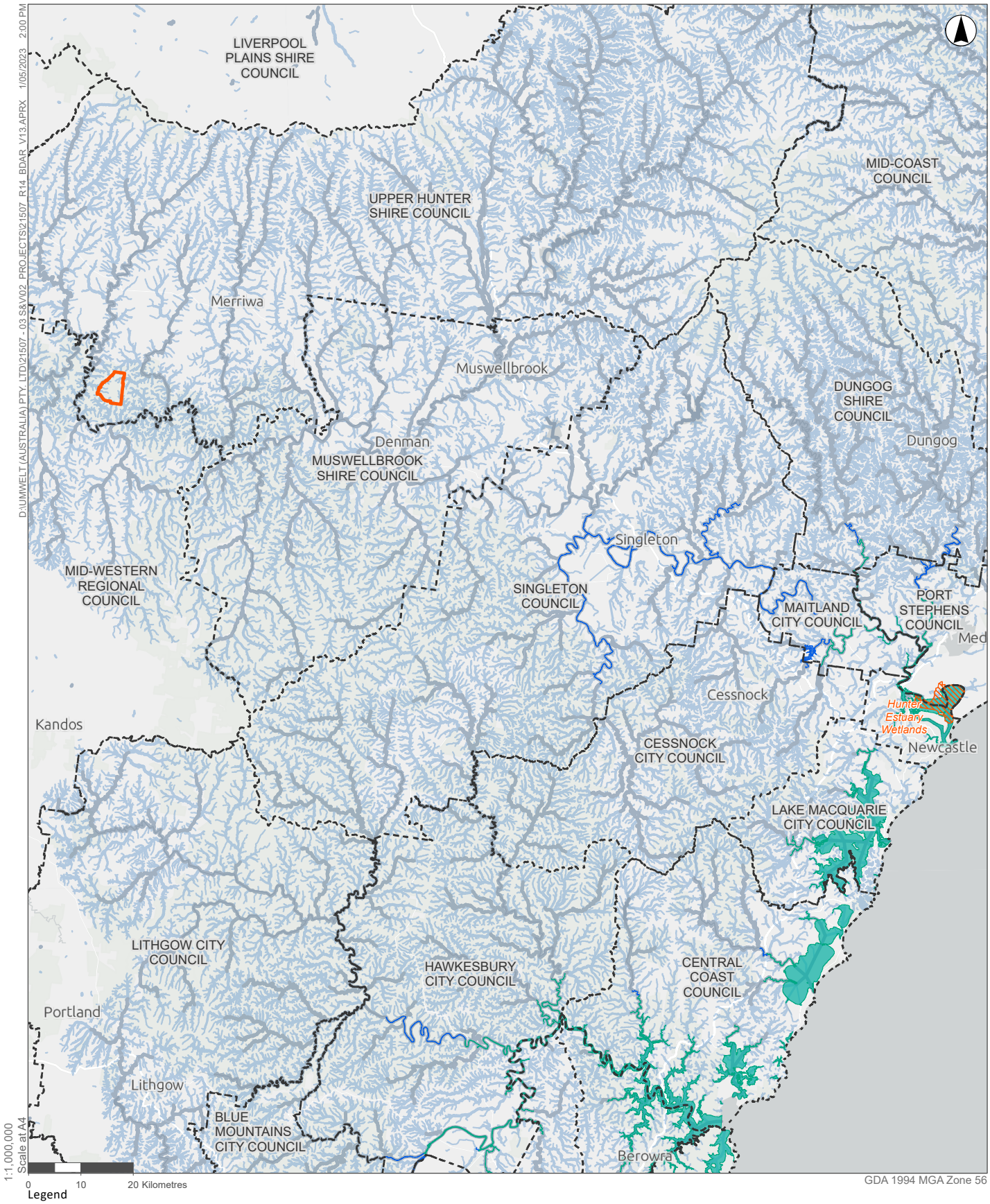


FIGURE 3.1

Rivers, Streams, Estuaries and Wetlands Downstream of the Subject Land

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

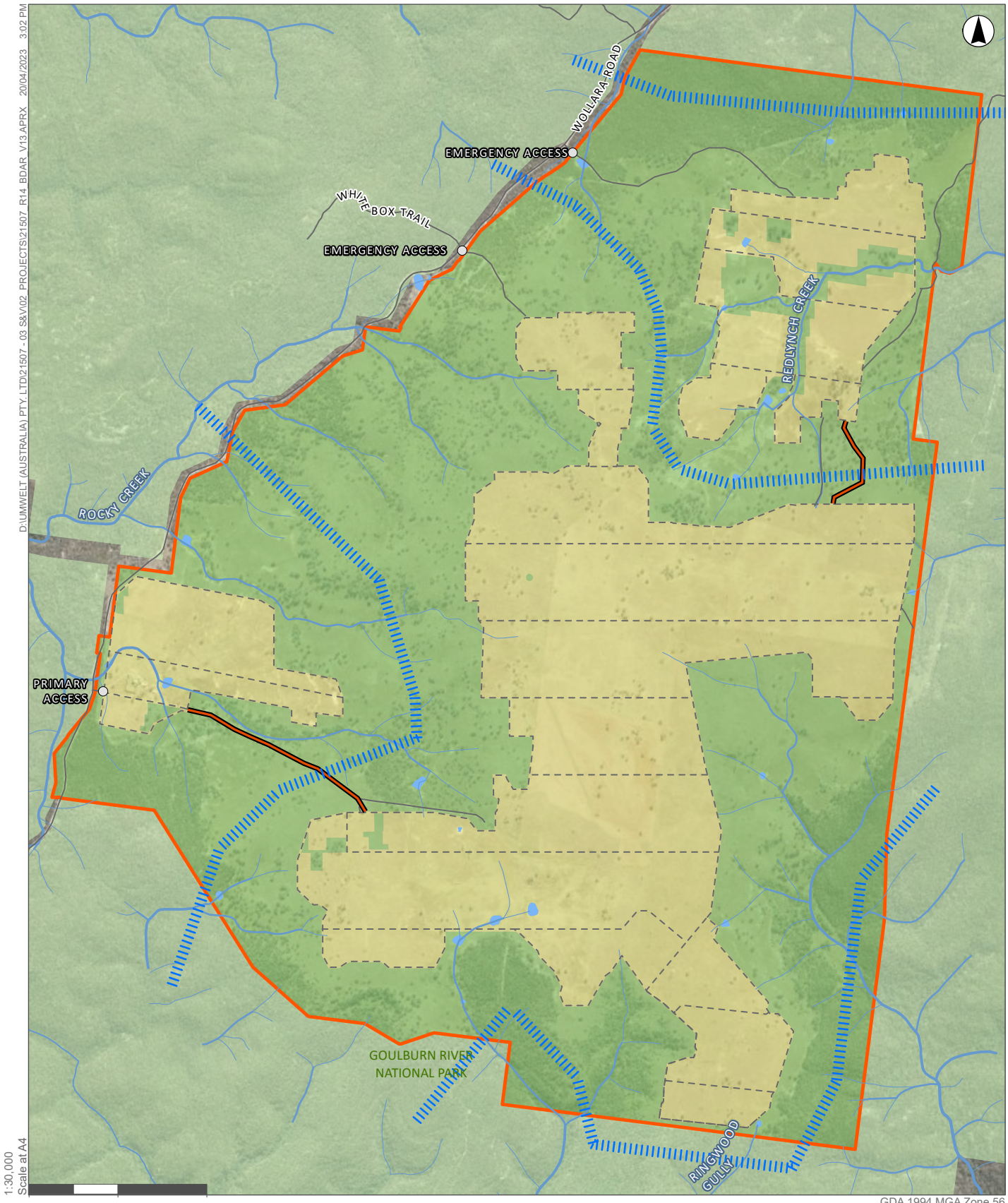


FIGURE 3.2

Habitat Connectivity

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

4.0 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity

4.1 Native Vegetation Extent

The parts of the Development Footprint assessed as native vegetation for the purposes of the vegetation integrity surveys are shown in **Figure 4.1**.

4.1.1 Changes to the Mapped Native Vegetation Extent

No notable changes were observed during surveys to the mapped native vegetation extent visible on the aerial imagery utilised for this assessment.

4.1.2 Areas That Are Not Native Vegetation

There are minor areas assessed as not native vegetation, these are situated around the existing dwelling where exotic vegetation has been established and in areas that are totally cleared including several small existing dams.

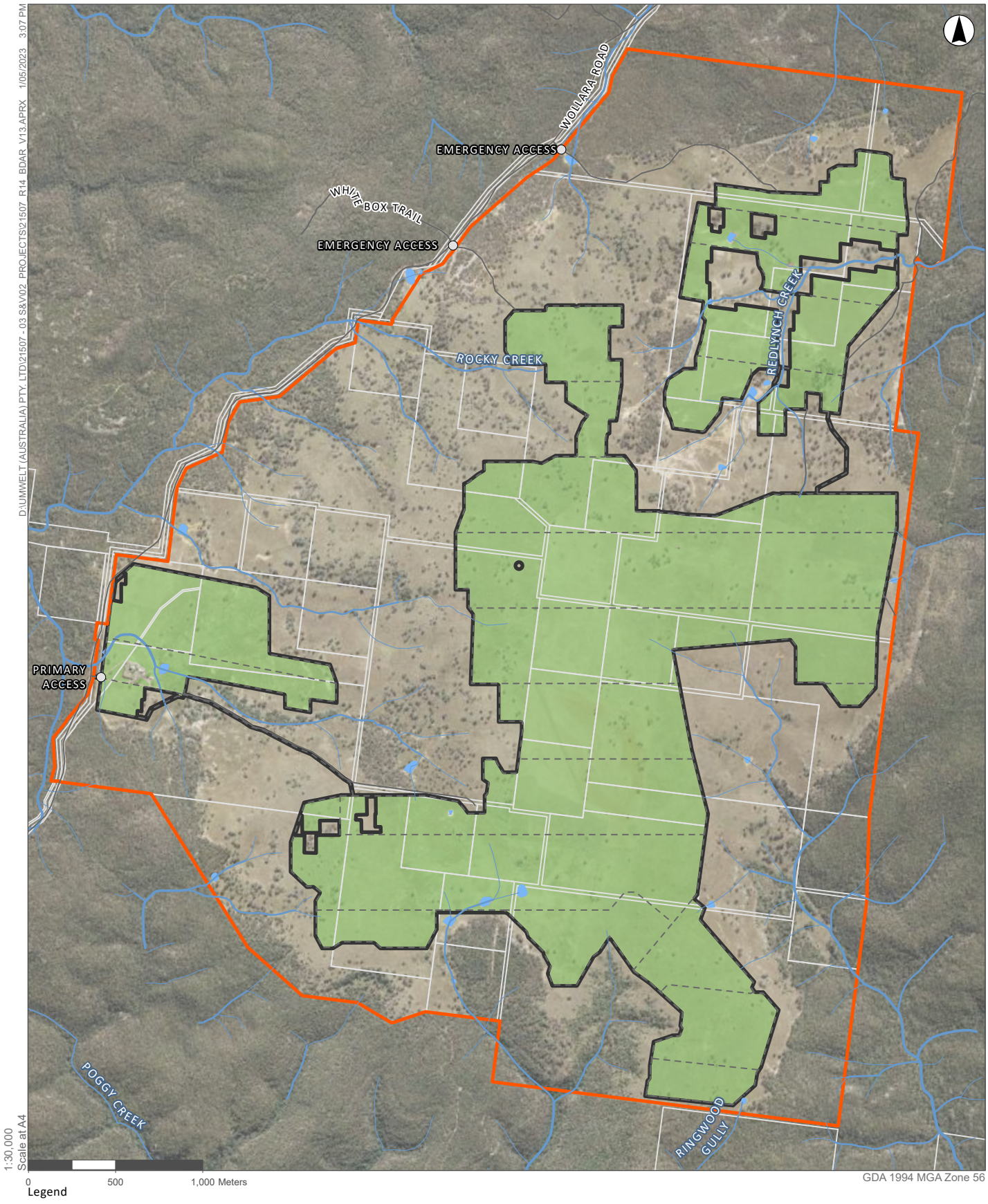


FIGURE 4.1

Development Footprint Native Vegetation Extents

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

4.2 Plant Community Types

4.2.1 Overview of PCTs Present

The PCTs identified in this assessment are based on the PCTs available prior to the release of the revised PCTs for eastern NSW and associated update to the BAM-C which occurred in February 2023. In-progress BAM-C assessments and projects with substantially progressed surveys are able to undertake this approach, in accordance with the transitional arrangements.

Vegetation within the Development Footprint has been assessed as aligning with the BioNet Vegetation Classification PCTs identified within **Table 4.1** and their extent is shown in **Figure 4.2**. Detailed descriptions of each PCT are provided in **Section 4.2.2**.

Surveys were also completed within the following PCTs which were originally part of the Development Footprint but later excluded as part of the impact avoidance measures achieved for the Project:

- PCT 1607 Blakely's Red Gum - Narrow-leaved Ironbark - Rough-barked Apple shrubby woodland of the upper Hunter (0.64 ha survey area).
- PCT 1655 Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin (0.83 ha survey area.

Table 4.1 Plant Community Types Identified within the Development Footprint

PCT ID	PCT name	Vegetation Class	Vegetation Formation	NSW VIS Percentage Cleared Estimate	Development Footprint Vegetation Condition Zone	Plots Completed	Condition Zone Area (ha)	Total PCT Area (ha)
483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	Western Slopes Grassy Woodlands	Grassy Woodlands	90%	Scattered Trees	5	23.64	699.63
					Moderate Condition Derived Native Grassland	18	168.48	
					Moderate to Low Condition Derived Native Grassland	19	308.37	
					Low Condition Derived Native Grassland	10	199.14	
1661	Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	Western Slopes Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	50%	Scattered Trees	4	6.07	96.10
					Moderate to Low Condition Derived Native Grassland	11	36.79	
					Low Condition Derived Native Grassland	5	53.24	
N/A	Waterbodies / Dams	N/A	N/A	N/A	N/A	N/A	1.60	1.60
N/A	Cleared Land	N/A	N/A	N/A	N/A	N/A	2.18	2.18

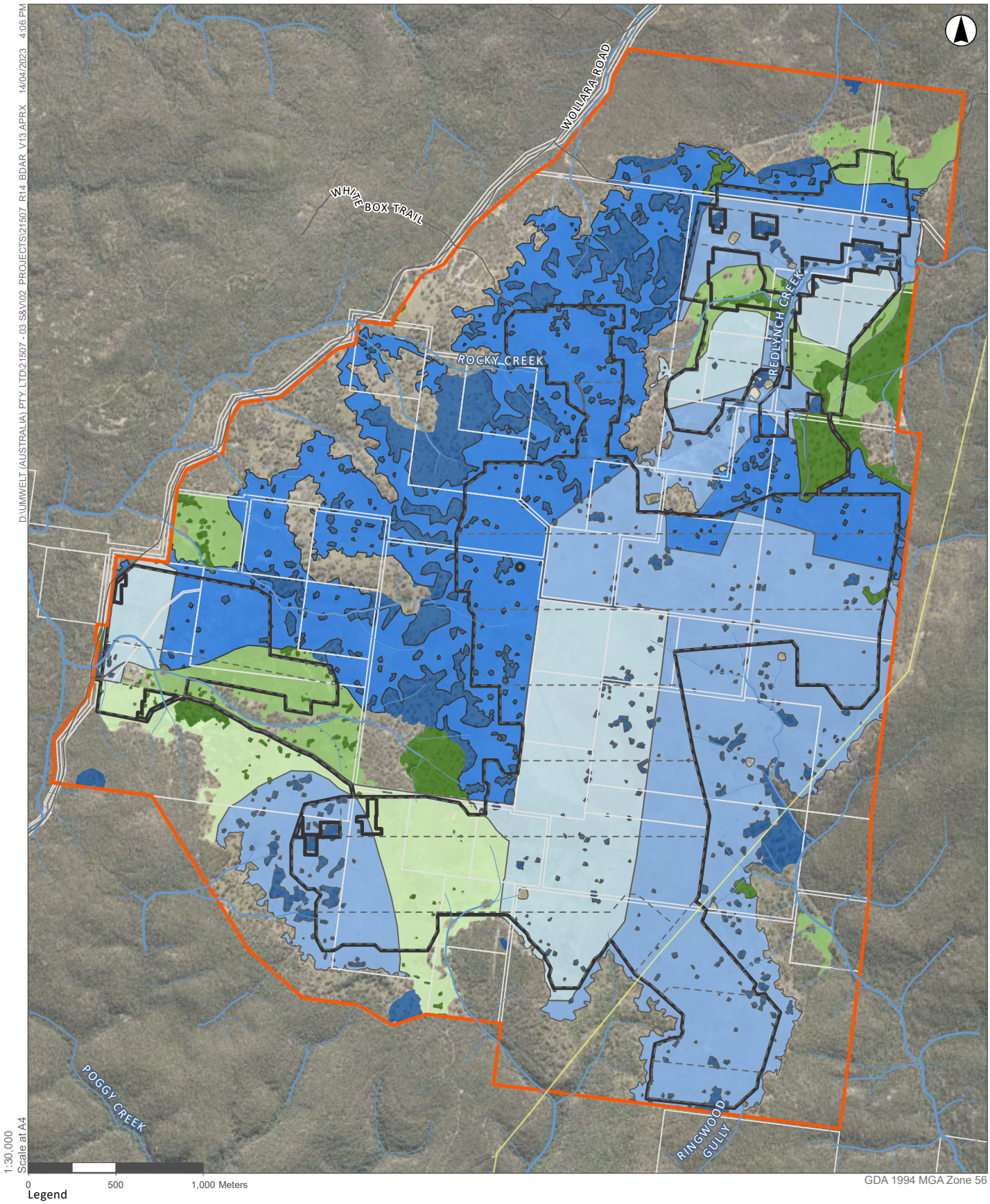


FIGURE 4.2

Plant Community Types and Vegetation Condition Zones

Image Source: ESRI Basemap (2021) **Data source:** NSW LPI (2021), NSW DSFI (2021); NPWS Estate (2019); Lightsource BP (2022)

4.2.2 Description of PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

4.2.2.1 PCT Description

PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley is the dominant PCT across the Development Footprint, its characteristics are summarised in **Table 4.2**. DPE (2022) have identified this PCT occurs as a mid-high to tall open woodland or woodland dominated by a White Box (*Eucalyptus albens*) x Grey Box (*Eucalyptus moluccana*) intergrade on brown to black earth, chocolate loam to clay soils derived from basalt on the Merriwa Plain and lower southern slopes of the Liverpool Range. This PCT is associated with the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the BC Act and the EBPC Act.

Table 4.2 Overview of PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley Characteristics

PCTID	483
PCT name	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley
Vegetation formation	Grassy Woodlands
Vegetation class	Western Slopes Grassy Woodland
Percent cleared value (%)	90%
Condition States and Extent within Development Footprint (ha)	Condition Zone 1 – Scattered Trees: 23.64 ha Condition Zone 2 – Moderate Condition Derived Native Grassland: 168.48 ha Condition Zone 3 – Moderate to Low Condition Derived Native Grassland: 308.37 ha Condition Zone 4 – Low Condition Derived Native Grassland: 199.14 ha Total Area: 669.63 ha
Location	The Development Footprint is centred on a fertile Basalt Cap. This PCT is associated with the Basalt Cap and the adjoining side slopes and flats. Within the Development Footprint it is replaced by PCT 1661 in areas of higher sandstone influence.
Floristic Description – Canopy Stratum	Where a canopy stratum is present the dominant tree species are *Eucalyptus moluccana*, *Eucalyptus albens* and the hybrid *Eucalyptus albens* x *moluccana*, which is referred to by some authors as *Eucalyptus albemol* (McRae and Cooper 1985).
Floristic Description – Mid Stratum	The mid stratum is typically absent due to historical clearing and ongoing pasture improvement and cattle grazing.
Floristic Description – Ground Stratum	The understorey is dominated by grasses including *Sporobolus creber, Bothriochloa macra, Austrostipa bigeniculata, Austrostipa scabra, Digitaria brownii, Aristida ramosa, Chloris truncata, Cynodon dactylon* with forbs such as *Dichondra repens, Calotis lappulacea* and *Glycine tabacina*.

4.2.2.2 Condition States and Alignment with BC Act and EPBC Act Listed TECs

This PCT has been mapped as occurring within the following four condition states within the Development Footprint.

ii. Condition Zone 1 – Scattered Trees

This condition state represents the areas of the Development Footprint which contain a canopy of scattered eucalypts over an understorey composed of derived native grassland.

This condition zone corresponds to the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the BC Act and the EPBC Act, where surrounded by areas of PCT 483 Condition Zone 2 Moderate Condition Derived Native Grassland and Condition Zone 3 Moderate to Low Condition Derived Native Grassland. This is due to the floristic assessment of these areas as forming patches of >0.1 ha with a predominantly native understorey with 12 or more understorey species present (excluding grasses), including at least one listed important species.

Areas of this condition zone surrounded by areas of Condition Zone 4 Low Condition Derived Native Grassland, correspond to the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the BC Act, but do not correspond to the EPBC listed variant of the CEEC due to these areas containing a predominantly exotic understorey. A photograph of this condition zone is provided as **Photo 4.1**.

Photo 4.1 PCT 483 Condition Zone 1 – Scattered Trees

iii. Condition Zone 2 – PCT 483 Moderate Condition Derived Native Grassland

This condition state represents the best condition derived native grassland areas of this PCT within the Development Footprint. Section 3.3.2 of the BAM Stage 1 Manual (DPIE 2020) identifies that separate vegetation zones are required for parts of the subject land where the vegetation has a current VI Score of <15 for a PCT representative of a CEEC. This approach has been applied for stratifying the areas of derived native grassland for PCT 483 and this condition zone represents the parts of the Development Footprint where the VI score is >15.

These areas typically contain grazing native vegetation and modified pastures with no tree stratum and low shrub cover. This condition zone is characterised by a very low cover of high threat exotics and litter cover was typically present in higher levels than lower quality condition zones.

This condition zone corresponds to the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the BC Act, and EPBC Act. There is no condition threshold for this CEEC under the BC Act. The condition thresholds for this CEEC under the EPBC Act are met, as this condition zone contains a predominantly native understorey, occurs in patch sizes of > 0.1 ha and more than 12 native understorey species (including one listed important species) are present. A photograph of this condition zone is provided as **Photo 4.2**.

Photo 4.2 PCT 483 Condition Zone 2 – Moderate Condition Derived Native Grassland

iv. Condition Zone 3 – Moderate to Low Condition Derived Native Grassland

This condition state represents an intermediate condition zone of PCT 483, between areas of moderate and low condition composed of derived native grassland. Section 3.3.2 of the BAM Stage 1 Manual (DPIE 2020) identifies that separate vegetation zones are required for parts of the subject land where they vegetation has a current VI Score of <15 for a PCT representative of a critically endangered ecological community. This approach has been applied for stratifying the areas of derived native grassland for PCT 483 and this condition zone represents the highest of two condition zones for PCT 483 where the VI score is <15.

These areas contained modified pastures with no trees and low shrub species richness and cover. Native grasses and forbs occur with a mixture of exotic flora species and with low cover and species richness of native ferns other native plants. These areas have been degraded by agricultural use and invasion of exotic species. This condition zone typically has poor overall function attributes, with some level of native vegetation resilience still present.

This condition zone also corresponds to the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC listed under the BC Act, and EPBC Act. There is no condition threshold for this CEEC under the BC Act. The condition threshold under the EPBC Act for this CEEC is met, as the understorey is predominantly native, all patches are > 0.1 ha in size and more than 12 native understorey species (including one listed important species) are present. A photograph of this condition zone is provided as **Photo 4.3**.

Photo 4.3 PCT 483 Condition Zone 3 Moderate to Low Condition Derived Native Grassland

v. Condition Zone 4 – PCT 483 Low Condition Derived Native Grassland

This condition state represents the lowest derived native grassland condition state of PCT 483 and is composed of areas of highly degraded agricultural land, which has been cropped or subject to high levels of pasture improvement and now contain a high cover of exotic flora species. There are no native trees, and the understorey typically has a low cover of native species. Section 3.3.2 of the BAM Stage 1 Manual (DPIE 2020) identifies that separate vegetation zones are required for parts of the subject land where they vegetation has a current VI Score of <15 for a PCT representative of a CEEC. This approach has been applied for stratifying the areas of derived native grassland for PCT 483 and this condition zone represents the lowest of two condition zones for PCT 483 where the VI score is <15.

This condition zone contains highly disturbed and typically exotic dominated grassland vegetation, characteristic of the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC. Mostly only low levels of native groundcover species are still present. It is the intent of the NSW Threatened Species Scientific Committee that all occurrences of the ecological community independent of their condition be covered by the listing under the BC Act and therefore these areas are considered a highly disturbed example of the White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC which has no realistic potential for recovery.

The condition threshold under the EPBC Act for this CEEC is however not met, as the patches of this condition zone do not have a predominantly native understorey, as determined by floristic plot surveys. A photograph of this condition zone is provided as **Photo 4.4**.

Photo 4.4 PCT 483 Condition Zone 4 Low Condition Derived Native Grassland

4.2.2.3 Justification for PCT Selection

The NSW VIS identifies that this PCT is characterised as a-high to tall open woodland or woodland dominated by a Grey Box (*Eucalyptus moluccana*) x White Box (*Eucalyptus albens*) intergrade forming a *Eucalyptus albens* x *moluccana* intermediate taxon. The trees tend to be closer to Grey Box than White Box over most of this region. Few other tree species occur with Rough-barked Apple (*Angophora floribunda*) and Yellow Box (*Eucalyptus melliodora*) occurring on footslopes and valley flats. Shrubs are absent or very sparse and include *Sclerolaena muricata*, *Sida trichopoda* and *Pimelea curviflora* var. *curviflora*. The ground cover is dense after rain but mid-dense to sparse in dry times. Grass species include *Austrostipa bigeniculata, Bothriochloa macra, Austrostipa aristiglumis, Elymus scaber* var. *scaber*, *Cynodon dactylon* and *Panicum queenslandicum* var. *queenslandicum*. The sedge *Cyperus gracilis* may be present. Forb species include *Boerhavia dominii, Oxalis perennans, Chamaesyce drummondii, Hibiscus trionum, Einadia nutans* subsp. *nutans, Asperula conferta, Rumex brownii, Mentha diemenica, Geranium solanderi* var. *solanderi* and *Calotis lappulacea*.

This PCT is described in the NSW VIS as occurring on brown to black earth, chocolate loam to clay soils derived from basalt on hillslopes, hillcrests, footslopes and valley flats on rolling hills and low hills on the Merriwa Plain and lower southern slopes of the Liverpool Range in the upper Hunter Valley in the far south-eastern corner of the Brigalow Belt South Bioregion.

The allocation and mapping of this PCT and condition zones was based on the presence of a grassy understorey with a scattered tree canopy dominated by *Eucalyptus moluccana, Eucalyptus albens* and the associated intermediate form between the two species. Other flora species identified in the VIS Scientific Description for this PCT which are present include *Pimelea curviflora, Austrostipa bigeniculata, Bothriochloa macra, Boerhavia dominii, Oxalis perennans, Elymus scaber, Anthosachne scabra, Cynodon dactylon, Chamaesyce drummondii, Einadia nutans, Austrostipa aristiglumis, Asperula conferta, Rumex brownii, Cyperus gracilis, Geranium solanderi, Calotis lappulacea* and *Chloris truncata*.

The following other PCTs were considered, but excluded from occurring from areas mapped as this PCT:

- PCT 618 White Box x Grey Box - red gum - Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley: This PCT was considered but excluded due to lack of diversity in the canopy, particularly the absence of *Eucalyptus blakelyi*, *Angophora floribunda*, *Eucalyptus tereticornis*, *Eucalyptus melliodora* and *Eucalyptus eugenioides*.

- PCT 1304 White Box - Narrow-leaved Ironbark grassy woodland of the Capertee Valley, Sydney Basin Bioregion: This PCT was considered but excluded due to the mismatch of several canopy species and the landscape position of basal Permian sediments of the Capertee Valley Floor.

- PCT 1606 White Box - Narrow-leaved Ironbark - Blakely's Red Gum shrubby open forest of the central and upper Hunter: is described as a forest or woodland with a canopy of *Eucalyptus albens* and *Eucalyptus crebra*. Both of these species are present within this PCT, however PCT 1606 does not include *Eucalyptus moluccana* or *Eucalyptus albemol* which occur within the Development Footprint.

- PCT 1609 White Box - White Cypress Pine - Native Olive woodland of upper Hunter and northern Wollemi: This PCT was considered and excluded due to mismatch in canopy floristics (*Callitris glaucophylla* absent) and understorey which is not strongly dominated by grasses.

- PCT 1610 White Box - Black Cypress Pine shrubby woodland of the Western Slopes: This PCT was considered and excluded due to mismatch in canopy floristics (*Callitris endlicheri* not present) and landscape position of lower slopes and flats of the Central Western Slopes.

- PCT 1691 Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter: This PCT was considered, it has a canopy of *Eucalyptus crebra* and *Brachychiton populneus* occurring with *Eucalyptus moluccana*, however *Eucalyptus albens* and *Eucalyptus albemol* are not identified as characteristic species. PCT 1691 is also described as occurring on coal bearing sedimentary geologies which are not present.

4.2.3 Description of PCT 1661 Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin

4.2.3.1 PCT Description

PCT 1661 Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin is described in the NSW VIS (DPE 2023) as an Ironbark Open Forest with a moderately dense to sparse mid-stratum and a grass/forb ground stratum. It generally occurs on sandstone hills in the Cassilis; Merriwa; Scone area and is found in the Goulburn River NP; Durridgere SCA and in the hills west of Scone on elevation ranges from about 250 to 500 m. This PCT is not associated with any threatened ecological communities.

Within the Development Footprint this PCT replaces PCT 483 Grey Box x White Box grassy open woodland in areas of higher sandstone influence. The characteristics of PCT 1661 are summarised in **Table 4.3**.

Table 4.3 Overview of PCT 1661 Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin Characteristics

PCTID	1661
PCT name	Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin
Vegetation formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation class	Western Slopes Dry Sclerophyll Forest
Percent cleared value (%)	50
Condition States and Extent within Development Footprint (ha)	Condition Zone 1 – Scattered Trees: 6.07 ha Condition Zone 2 – Moderate to Low Condition Derived Native Grassland: 36.79 ha Condition Zone 3 – Low Condition Derived Native Grassland: 53.24 ha Total Area: 96.10 ha
Location	This PCT occurs in areas of sandstone influence, particularly around the edges of the Development Footprint and in lower elevation parts which have not been subject to nutrient enrichment associated with Basalt derived soils and geology.
Floristic Description – Canopy Stratum	Where a canopy stratum is present the dominant tree species are *Eucalyptus crebra* and *Allocasuarina luehmannii* with an absence of other eucalypts.
Floristic Description – Mid Stratum	The mid stratum is typically absent due to historical clearing and ongoing pasture improvement and cattle grazing.

PCTID	1661
Floristic Description - Ground Stratum	The understorey is dominated by grasses including *Sporobolus creber, Chloris ventricosa, Austrostipa verticillata* and *Eremophila debilis* with varying levels of exotics such as *Sida rhombifolia, Gomphocarpus fruticosus* and *Senecio madagascariensis*.

4.2.3.2 Condition states and Alignment with BC Act and EPBC Act Listed TECs

i. Condition Zone 1 – Scattered Trees

This condition zone represents the areas of the Development Footprint which contain a canopy of scattered eucalypts over an understorey composed of derived native grassland.

This PCT and condition zone do not correspond to any threatened ecological communities listed under the BC Act or the EPBC Act. A photograph of this condition zone is provided as **Photo 4.5**.

Photo 4.5 PCT 1661 Condition Zone 1 – Scattered Trees

ii. Condition Zone 2 – PCT 1661 Moderate to Low Condition Derived Native Grassland

This condition state represents the best quality areas of derived native grassland for this PCT, however are still in an overall low condition with a vegetation integrity score of <15.

These areas contained grazed native vegetation / modified pastures with no trees and low shrub species richness and cover. Native grasses and forbs occur with a mixture of exotic flora species and with low cover and species richness of native ferns other native plants. These areas have been degraded to some extent by agricultural use and invasion of exotic species.

This PCT and condition zone do not correspond to any threatened ecological communities listed under the BC Act or the EPBC Act. A photograph of this condition zone is provided as **Photo 4.6**.

Photo 4.6 PCT 1661 Condition Zone 1 – Moderate to Low Derived Native Grassland

iii. Condition Zone 3 – PCT 1661 Low Condition Derived Native Grassland

This condition state represents the lowest derived native grassland condition state of PCT 1661 and is composed of areas of highly degraded agricultural land, which has been subject to high levels of pasture improvement and now contain a high cover of exotic flora species. There are no native trees and the understorey typically has a low cover of native species. This condition state represents the lowest condition zone of PCT 1661 composed of derived native grassland, with a very low vegetation integrity score.

This PCT and condition zone do not correspond to any threatened ecological communities listed under the BC Act or the EPBC Act. A photograph of this condition zone is provided as **Photo 4.7**.

Photo 4.7 PCT 1661 Condition Zone 1 – Low Condition Derived Native Grassland

4.2.3.3 Justification for PCT Selection

The NSW VIS describes PCT 1661 as an ironbark open forest with a moderately dense to sparse mid-stratum and a grass/forb ground stratum, occurring on sandstone hills.

The site vegetation corresponds with PCT 1661 as it has a canopy dominated by *Eucalyptus crebra, o*ccurs on similar topography to adjoining undisturbed areas which have *Callitris endlicheri* as a dominant sub-canopy species, occurs in areas with visible sandstone outcropping, associated with Narrabeen Sandstone geology, occurs in the Merriwa area, and is surrounded by the Goulburn River National Park and matches the elevation range for the PCT of 250 to 500 m.

The lineage for this PCT shows that it is replaced by two PCTs, including PCT 3768 Upper Hunter Ranges Enriched Ironbark Forest which corresponds floristically with the areas of PCT 1661 present and is mapped on the State Vegetation Type Map in areas adjoining the Development Footprint.

The following other PCTs were considered, but excluded from occurring from areas mapped as this PCT:

- PCT 1654 Narrow-leaved Ironbark - Grey Gum shrubby open forest on sandstone ranges of the upper Hunter Valley: Considered and excluded due to mismatch in canopy floristics, specifically the lack of *Eucalyptus punctata* and *Angophora floribunda* within the Development Footprint and adjoining areas.
- PCT 1672 Red Ironbark - Grey Gum - Black Pine heathy woodland on sandstone ranges of the Sydney Basin: Considered and excluded due to floristic mismatch, including the lack of *Eucalyptus fibrosa* and *Eucalyptus punctata* within the Development Footprint.
- PCT 1674 Red Ironbark - Brown Bloodwood - Black Pine heathy open forest on sandstone ranges of the Sydney Basin: Considered and excluded due to lack of *Eucalyptus fibrosa* and *Corymbia trachyphloia*.

4.2.4 Other PCTs Surveyed within the Project Area

The following PCTs were surveyed as part of a larger Development Footprint which was subsequently reduced and will now be retained as a part of the impact avoidance measures implemented for the Project:

- PCT 1607 Blakely's Red Gum – Narrow-leaved Ironbark – Rough-barked Apple shrubby woodland of the upper Hunter: This PCT occurs in the south-western section of the Project Area along an ephemeral drainage line. The tree stratum is intact and dominated by *Angophora floribunda* and *Eucalyptus crebra* with *Allocasuarina luehmannii* as a sub-dominant. The shrub stratum is sparse where present and dominated by *Notelaea microcarpa* and *Ozothamnus diosmifolius*, and the understorey consists of grazed land dominated by *Microlaena stipoides* with a variety of other herbs and forbs. It does not correspond to any BC Act or EPBC Act listed TECs.
- PCT 1655 Grey Box – Slaty Box shrub – grass woodland in sandstone slopes of the upper Hunter and Sydney Basin: The surveyed areas of this PCT consist of a patch of remnant *Eucalyptus dawsonii* trees, the shrub stratum is sparse to absent and the understorey consists of grazed land dominated by grasses including *Austrostipa verticillata*, *Microlaena stipoides* and *Chloris truncata.* This patch will be retained within the northern part of the Development Footprint.

This PCT is associated with the Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion vulnerable ecological community (VEC). There are floristic similarities between this PCT and the Central Hunter Valley Eucalypt Forest and Woodland which is listed as a CEEC under the EPBC Act, however the key diagnostic feature of occurring on lower hillslopes and low ridges or valley floors in undulating country on soil derived from Permian sedimentary rocks is not met, as this PCT occurs on the Wollar Road Soil Landscape, which is characterised by ironstone-rich Triassic sandstone of the Narrabeen Group adjacent to basalt (NSW OEH 2018).

4.2.5 Cleared Land and Waterbodies

The Development Footprint contains approximately 2.01 ha mapped as cleared land which is mostly composed of vehicle tracks, 0.17 ha mapped as exotic vegetation around the existing dwelling and 1.6 ha mapped as waterbodies associated with farm dams.

4.3 Threatened Ecological Communities

One TEC, the critically endangered White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland occurs within the Development Footprint. This CEEC corresponds to areas mapped as PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley. The BC Act listing of this CEEC includes all mapped condition zones, as the final determination identifies that it is the intent of the NSW Threatened Species Scientific Committee that all occurrences of the ecological community independent of their condition be covered by the listing under the BC Act.

The EPBC Act listing for this CEEC includes the following condition zones:

- PCT 483 Condition Zone 1 – Scattered Trees (excluding those areas which are surrounded by low condition derived native grassland vegetation zone and contain a predominantly exotic understorey).
- PCT 483 Condition Zone 2 – Moderate condition derived native grassland.
- PCT 483 Condition Zone 3 – Moderate to low condition derived native grassland.
- For the vegetation condition zone, PCT 483 Condition Zone 4 – Low Condition Derived Native Grassland, the condition threshold under the EPBC Act for this CEEC is not met. This due to these patches not having a predominantly native understorey, as determined by the floristic plot surveys completed.

Threatened ecological community associations for the PCTs observed are discussed in **Section 4.2** of this Report. The details of the threatened ecological communities identified within the Development Footprint are also listed in **Table 4.4** and the extent of each TEC is mapped in **Figure 4.3**.

Table 4.4 TECs within the Development Footprint

TEC Name	Profile ID (from TBDC)	Act and Listing Status	Associated PCTs and vegetation condition zones within the Development Footprint	Area within Development Footprint (ha)
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions	10837	Critically Endangered Ecological Community Listed under the BC Act	PCT 483 Condition Zone 1 – Scattered Trees (23.64 ha) PCT 483 Condition Zone 2 – Moderate Condition Derived Native Grassland (168.48 ha) PCT 483 Condition Zone 3 – Moderate to Low Condition Derived Native Grassland (308.37 ha) PCT 483 Condition Zone 4 – Low Condition Derived Native Grassland (199.14 ha)	699.63 ha
White Box-Yellow Box-Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands	20392	Critically Endangered Ecological Community Listed under the EPBC Act	PCT 483 Condition Zone 1 – Scattered Trees (excluding areas surrounded by PCT 483 Condition Zone 4) (19.26 ha) PCT 483 Condition Zone 2 – Moderate Condition Derived Native Grassland (168.48 ha) PCT 483 Condition Zone 3 – Moderate to Low Condition Derived Native Grassland (308.37 ha)	496.11 ha